PATENT COOPERATION TREATY

From the INTERNATIONAL BUREAU

PCT

NOTIFICATION OF ELECTION

(PCT Rule 61.2)

To:

Assistant Commissioner for Patents
United States Patent and Trademark Office
Box PCT
Washington, D.C.20231
ETATS-UNIS D'AMERIQUE

in its capacity as elected Office

Date of mailing: 30 March 2000 (30.03.00)	
International application No.: PCT/GB99/02863	Applicant's or agent's file reference: PADL/38884
International filing date: 01 September 1999 (01.09.99)	Priority date: 18 September 1998 (18.09.98)
Applicant: LEWIS, Michael, Vincent et al	

1. The designated Office is hereby notified of its election made:

[X] in the demand filed with the International preliminary Examining Authority on:

20 January 2000 (20.01.00)

[ ] in a notice effecting later election filed with the International Bureau on:

2. The election [X] was

[ ] was not

made before the expiration of 19 months from the priority date or, where Rule 32 applies, within the time limit under Rule 32.2(b).

The International Bureau of WIPO
34, chemin des Colombettes
1211 Geneva 20, Switzerland

Facsimile No.: (41-22) 740.14.35

Authorized officer:

J. Zahra

Telephone No.: (41-22) 338.83.38

PATENT COOPERATION TREATY

From the INTERNATIONAL BUREAU

PCT

NOTIFICATION OF THE RECORDING OF A CHANGE

(PCT Rule 92bis.1 and Administrative Instructions, Section 422)

To:

DALE, Martin, Nicholas
Reckitt & Colman plc
Group Patents Dept.
Dansom Lane
Hull HU8 7DS
ROYAUME-UNI

Date of mailing (day/month/year)
07 February 2000 (07.02.00)

Applicant's or agent's file reference
10184P1 WO/MD

IMPORTANT NOTIFICATION

International application No.
PCT/GB98/02863

International filing date (day/month/year)
22 September 1998 (22.09.98)

1. The following indications appeared on record concerning:

[X] the applicant [X] the inventor [ ] the agent [ ] the common representative

Name and Address
SUH, Janette
690-F River Road
New Milford, NJ 07646
United States of America

State of Nationality: US
State of Residence: US
Telephone No.:
Facsimile No.:
Teleprinter No.:

2. The International Bureau hereby notifies the applicant that the following change has been recorded concerning:

[ ] the person [ ] the name [X] the address [ ] the nationality [ ] the residence

Name and Address
SUH, Janette
45 Cheltenham Drive
Wyomissing, PA 19610
United States of America

State of Nationality: US
State of Residence: US
Telephone No.:
Facsimile No.:
Teleprinter No.:

3. Further observations, if necessary:

4. A copy of this notification has been sent to:

[X] the receiving Office
[ ] the International Searching Authority
[ ] the International Preliminary Examining Authority
[ ] the designated Offices concerned
[X] the elected Offices concerned
[ ] other:

The International Bureau of WIPO
34, chemin des Colombettes
1211 Geneva 20, Switzerland

Facsimile No.: (41-22) 740.14.35

Authorized officer
Céline Faust

Telephone No.: (41-22) 338.83.38

f1c.

PCT

REQUEST

The undersigned requests that the present international application be processed according to the Patent Cooperation Treaty.

For receiving Office use only

International Application No.

International Filing Date

Name of receiving Office and "PCT International Application"

Applicant's or agent's file reference *(if desired) (12 characters maximum)* PADL/38884

Box No. I TITLE OF INVENTION

CIGARETTE MANUFACTURING MACHINE AND CONTROL SYSTEM THEREFOR

Box No. II APPLICANT

Name and address: *(Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no State of residence is indicated below.)*

PHILIP MORRIS PRODUCTS INC.
3610 COMMERCE ROAD
RICHMOND
VIRGINIA 23234
UNITED STATES OF AMERICA

☐ This person is also inventor.

Telephone No.

Facsimile No.

Teleprinter No.

State *(that is, country)* of nationality: US

State *(that is, country)* of residence: US

This person is applicant for the purposes of: ☐ all designated States ☒ all designated States except the United States of America ☐ the United States of America only ☐ the States indicated in the Supplemental Box

Box No. III FURTHER APPLICANT(S) AND/OR (FURTHER) INVENTOR(S)

Name and address: *(Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no State of residence is indicated below.)*

MICHAEL VINCENT LEWIS
24, BERTHER ROAD
HORNCHURCH
ESSEX RM11 3HS

This person is:

☐ applicant only

☒ applicant and inventor

☐ inventor only *(If this check-box is marked, do not fill in below.)*

State *(that is, country)* of nationality: GB

State *(that is, country)* of residence: GB

This person is applicant for the purposes of: ☐ all designated States ☐ all designated States except the United States of America ☒ the United States of America only ☐ the States indicated in the Supplemental Box

☒ Further applicants and/or (further) inventors are indicated on a continuation sheet.

Box No. IV AGENT OR COMMON REPRESENTATIVE; OR ADDRESS FOR CORRESPONDENCE

The person identified below is hereby/has been appointed to act on behalf of the applicant(s) before the competent International Authorities as: ☐ agent ☒ common representative

Name and address: *(Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country.)*

LLOYD, PATRICK, ALEXANDER DESMOND
REDDIE & GROSE
16, THEOBALDS ROAD
LONDON
WC1X 8PL
ENGLAND

Telephone No. +44 171 242 0901

Facsimile No. +44 171 242 3290

Teleprinter No. 25445

☐ **Address for correspondence:** Mark this check-box where no agent or common representative is/has been appointed and the space above is used instead to indicate a special address to which correspondence should be sent.

Continuation of Box No. III FURTHER APPLICANT(S) AND/OR (FURTHER) INVENTOR(S)

If none of the following sub-boxes is used, this sheet should not be included in the request.

Name and address: *(Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no State of residence is indicated below.)*

ROBERT JOHN GREEN
131a, RAVENSBOURNE AVENUE
BROMLEY
KENT
BR2 0AZ

This person is:
- [ ] applicant only
- [X] applicant and inventor
- [ ] inventor only *(If this check-box is marked, do not fill in below.)*

State *(that is, country)* of nationality: GB

State *(that is, country)* of residence: GB

This person is applicant for the purposes of:
- [ ] all designated States
- [ ] all designated States except the United States of America
- [X] the United States of America only
- [ ] the States indicated in the Supplemental Box

Name and address: *(Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no State of residence is indicated below.)*

KEITH JOHN CADGE
90 MOULSHAM DRIVE
CHELMSFORD
ESSEX
CM2 2PY

This person is:
- [ ] applicant only
- [X] applicant and inventor
- [ ] inventor only *(If this check-box is marked, do not fill in below.)*

State *(that is, country)* of nationality: GB

State *(that is, country)* of residence: GB

This person is applicant for the purposes of:
- [ ] all designated States
- [ ] all designated States except the United States of America
- [X] the United States of America only
- [ ] the States indicated in the Supplemental Box

Name and address: *(Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no State of residence is indicated below.)*

KEITH CHARLES LOUGHREY
21 THE GROVE
BEXLEY HEATH
KENT
DA6 8HD

This person is:
- [ ] applicant only
- [X] applicant and inventor
- [ ] inventor only *(If this check-box is marked, do not fill in below.)*

State *(that is, country)* of nationality: GB

State *(that is, country)* of residence: GB

This person is applicant for the purposes of:
- [ ] all designated States
- [ ] all designated States except the United States of America
- [X] the United States of America only
- [ ] the States indicated in the Supplemental Box

Name and address: *(Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no State of residence is indicated below.)*

DAVID THOMAS DAVIS
4 EDISON GROVE
PLUMSTEAD
LONDON
SE18 2DN

This person is:
- [ ] applicant only
- [X] applicant and inventor
- [ ] inventor only *(If this check-box is marked, do not fill in below.)*

State *(that is, country)* of nationality: GB

State *(that is, country)* of residence: GB

This person is applicant for the purposes of:
- [ ] all designated States
- [ ] all designated States except the United States of America
- [X] the United States of America only
- [ ] the States indicated in the Supplemental Box

[X] Further applicants and/or (further) inventors are indicated on another continuation sheet.

Continuation of Box No. III FURTHER APPLICANT(S) AND/OR (FURTHER) INVENTOR(S)

If none of the following sub-boxes is used, this sheet should not be included in the request.

Name and address: *(Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no State of residence is indicated below.)*

PAUL WYKES
61 BETTERTON ROAD
RAINHAM
ESSEX
RM13 8NB

This person is:
- ☐ applicant only
- ☒ applicant and inventor
- ☐ inventor only *(If this check-box is marked, do not fill in below.)*

State *(that is, country)* of nationality: GB

State *(that is, country)* of residence: GB

This person is applicant for the purposes of:
- ☐ all designated States
- ☐ all designated States except the United States of America
- ☒ the United States of America only
- ☐ the States indicated in the Supplemental Box

Name and address: *(Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no State of residence is indicated below.)*

MALCOLM KENNETH SIMMS
34 BLITHDALE ROAD
ABBEY WOOD
LONDON
SE2 9HJ

This person is:
- ☐ applicant only
- ☒ applicant and inventor
- ☐ inventor only *(If this check-box is marked, do not fill in below.)*

State *(that is, country)* of nationality: GB

State *(that is, country)* of residence: GB

This person is applicant for the purposes of:
- ☐ all designated States
- ☐ all designated States except the United States of America
- ☒ the United States of America only
- ☐ the States indicated in the Supplemental Box

Name and address: *(Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no State of residence is indicated below.)*

This person is:
- ☐ applicant only
- ☐ applicant and inventor
- ☐ inventor only *(If this check-box is marked, do not fill in below.)*

State *(that is, country)* of nationality:

State *(that is, country)* of residence:

This person is applicant for the purposes of:
- ☐ all designated States
- ☐ all designated States except the United States of America
- ☐ the United States of America only
- ☐ the States indicated in the Supplemental Box

Name and address: *(Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no State of residence is indicated below.)*

This person is:
- ☐ applicant only
- ☐ applicant and inventor
- ☐ inventor only *(If this check-box is marked, do not fill in below.)*

State *(that is, country)* of nationality:

State *(that is, country)* of residence:

This person is applicant for the purposes of:
- ☐ all designated States
- ☐ all designated States except the United States of America
- ☐ the United States of America only
- ☐ the States indicated in the Supplemental Box

☐ Further applicants and/or (further) inventors are indicated on another continuation sheet.

Box No.V DESIGNATION OF STATES

The following designations are hereby made under Rule 4.9(a) *(mark the applicable check-boxes; at least one must be marked)*:

Regional Patent

- ☒ **AP** **ARIPO Patent:** GH Ghana, GM Gambia, KE Kenya, LS Lesotho, MW Malawi, SD Sudan, SL Sierra Leone, SZ Swaziland, UG Uganda, ZW Zimbabwe, and any other State which is a Contracting State of the Harare Protocol and of the PCT
- ☒ **EA** **Eurasian Patent:** AM Armenia, AZ Azerbaijan, BY Belarus, KG Kyrgyzstan, KZ Kazakhstan, MD Republic of Moldova, RU Russian Federation, TJ Tajikistan, TM Turkmenistan, and any other State which is a Contracting State of the Eurasian Patent Convention and of the PCT
- ☒ **EP** **European Patent:** AT Austria, BE Belgium, CH and LI Switzerland and Liechtenstein, CY Cyprus, DE Germany, DK Denmark, ES Spain, FI Finland, FR France, GB United Kingdom, GR Greece, IE Ireland, IT Italy, LU Luxembourg, MC Monaco, NL Netherlands, PT Portugal, SE Sweden, and any other State which is a Contracting State of the European Patent Convention and of the PCT
- ☒ **OA** **OAPI Patent:** BF Burkina Faso, BJ Benin, CF Central African Republic, CG Congo, CI Côte d'Ivoire, CM Cameroon, GA Gabon, GN Guinea, GW Guinea-Bissau, ML Mali, MR Mauritania, NE Niger, SN Senegal, TD Chad, TG Togo, and any other State which is a member State of OAPI and a Contracting State of the PCT *(if other kind of protection or treatment desired, specify on dotted line)* .....

National Patent *(if other kind of protection or treatment desired, specify on dotted line)*:

- ☒ **AE** United Arab Emirates
- ☒ **AL** Albania .....
- ☒ **AM** Armenia .....
- ☒ **AT** Austria .....
- ☒ **AU** Australia .....
- ☒ **AZ** Azerbaijan
- ☒ **BA** Bosnia and Herzegovina .....
- ☒ **BB** Barbados
- ☒ **BG** Bulgaria .....
- ☒ **BR** Brazil .....
- ☒ **BY** Belarus .....
- ☒ **CA** Canada
- ☒ **CH and LI** Switzerland and Liechtenstein
- ☒ **CN** China .....
- ☒ **CU** Cuba .....
- ☒ **CZ** Czech Republic .....
- ☒ **DE** Germany .....
- ☒ **DK** Denmark .....
- ☒ **EE** Estonia .....
- ☒ **ES** Spain .....
- ☒ **FI** Finland .....
- ☒ **GB** United Kingdom
- ☒ **GD** Grenada
- ☒ **GE** Georgia .....
- ☒ **GH** Ghana .....
- ☒ **GM** Gambia
- ☒ **HR** Croatia .....
- ☒ **HU** Hungary .....
- ☒ **ID** Indonesia
- ☒ **IL** Israel .....
- ☒ **IN** India .....
- ☒ **IS** Iceland
- ☒ **JP** Japan .....
- ☒ **KE** Kenya .....
- ☒ **KG** Kyrgyzstan .....
- ☒ **KP** Democratic People's Republic of Korea .....
- ☒ **KR** Republic of Korea .....
- ☒ **KZ** Kazakhstan .....
- ☒ **LC** Saint Lucia
- ☒ **LK** Sri Lanka
- ☒ **LR** Liberia
- ☒ **LS** Lesotho .....
- ☒ **LT** Lithuania
- ☒ **LU** Luxembourg
- ☒ **LV** Latvia
- ☒ **MD** Republic of Moldova .....
- ☒ **MG** Madagascar .....
- ☒ **MK** The former Yugoslav Republic of Macedonia .....
- ☒ **MN** Mongolia
- ☒ **MW** Malawi .....
- ☒ **MX** Mexico .....
- ☒ **NO** Norway
- ☒ **NZ** New Zealand .....
- ☒ **PL** Poland .....
- ☒ **PT** Portugal .....
- ☒ **RO** Romania
- ☒ **RU** Russian Federation .....
- ☒ **SD** Sudan
- ☒ **SE** Sweden
- ☒ **SG** Singapore
- ☒ **SI** Slovenia .....
- ☒ **SK** Slovakia .....
- ☒ **SL** Sierra Leone .....
- ☒ **TJ** Tajikistan .....
- ☒ **TM** Turkmenistan .....
- ☒ **TR** Turkey .....
- ☒ **TT** Trinidad and Tobago .....
- ☒ **UA** Ukraine .....
- ☒ **UG** Uganda .....
- ☒ **US** United States of America .....
- ☒ **UZ** Uzbekistan .....
- ☒ **VN** Viet Nam .....
- ☒ **YU** Yugoslavia .....
- ☒ **ZA** South Africa .....
- ☒ **ZW** Zimbabwe .....

Check-boxes reserved for designating States which have become party to the PCT after issuance of this sheet:

- ☐ PG Papua New Guinea .....
- ☐ CR Costa Rica .....

Precautionary Designation Statement: In addition to the designations made above, the applicant also makes under Rule 4.9(b) all other designations which would be permitted under the PCT except any designation(s) indicated in the Supplemental Box as being excluded from the scope of this statement. The applicant declares that those additional designations are subject to confirmation and that any designation which is not confirmed before the expiration of 15 months from the priority date is to be regarded as withdrawn by the applicant at the expiration of that time limit. *(Confirmation of a designation consists of the filing of a notice specifying that designation and the payment of the designation and confirmation fees. Confirmation must reach the receiving Office within the 15-month time limit.)*

See Notes to the request form

Box No.V DESIGNATION OF STATES

The following designations are hereby made under Rule 4.9(a) *(mark the applicable check-boxes; at least one must be marked)*:

Regional Patent

- ☐ **AP** **ARIPO Patent:** GH Ghana, GM Gambia, KE Kenya, LS Lesotho, MW Malawi, SD Sudan, SL Sierra Leone, SZ Swaziland, UG Uganda, ZW Zimbabwe, and any other State which is a Contracting State of the Harare Protocol and of the PCT
- ☐ **EA** **Eurasian Patent:** AM Armenia, AZ Azerbaijan, BY Belarus, KG Kyrgyzstan, KZ Kazakhstan, MD Republic of Moldova, RU Russian Federation, TJ Tajikistan, TM Turkmenistan, and any other State which is a Contracting State of the Eurasian Patent Convention and of the PCT
- ☐ **EP** **European Patent:** AT Austria, BE Belgium, CH and LI Switzerland and Liechtenstein, CY Cyprus, DE Germany, DK Denmark, ES Spain, FI Finland, FR France, GB United Kingdom, GR Greece, IE Ireland, IT Italy, LU Luxembourg, MC Monaco, NL Netherlands, PT Portugal, SE Sweden, and any other State which is a Contracting State of the European Patent Convention and of the PCT
- ☐ **OA** **OAPI Patent:** BF Burkina Faso, BJ Benin, CF Central African Republic, CG Congo, CI Côte d'Ivoire, CM Cameroon, GA Gabon, GN Guinea, GW Guinea-Bissau, ML Mali, MR Mauritania, NE Niger, SN Senegal, TD Chad, TG Togo, and any other State which is a member State of OAPI and a Contracting State of the PCT *(if other kind of protection or treatment desired, specify on dotted line)* .....

National Patent *(if other kind of protection or treatment desired, specify on dotted line)*:

- ☐ **AE** United Arab Emirates
- ☐ **AL** Albania .....
- ☐ **AM** Armenia .....
- ☐ **AT** Austria .....
- ☐ **AU** Australia .....
- ☐ **AZ** Azerbaijan
- ☐ **BA** Bosnia and Herzegovina .....
- ☐ **BB** Barbados
- ☐ **BG** Bulgaria .....
- ☐ **BR** Brazil .....
- ☐ **BY** Belarus .....
- ☐ **CA** Canada
- ☐ **CH and LI** Switzerland and Liechtenstein
- ☐ **CN** China .....
- ☐ **CU** Cuba .....
- ☐ **CZ** Czech Republic .....
- ☐ **DE** Germany .....
- ☐ **DK** Denmark .....
- ☐ **EE** Estonia .....
- ☐ **ES** Spain .....
- ☐ **FI** Finland .....
- ☐ **GB** United Kingdom
- ☐ **GD** Grenada
- ☐ **GE** Georgia .....
- ☐ **GH** Ghana .....
- ☐ **GM** Gambia
- ☐ **HR** Croatia .....
- ☐ **HU** Hungary .....
- ☐ **ID** Indonesia
- ☐ **IL** Israel .....
- ☐ **IN** India .....
- ☐ **IS** Iceland
- ☐ **JP** Japan .....
- ☐ **KE** Kenya .....
- ☐ **KG** Kyrgyzstan .....
- ☐ **KP** Democratic People's Republic of Korea .....
- ☐ **KR** Republic of Korea .....
- ☐ **KZ** Kazakhstan .....
- ☐ **LC** Saint Lucia
- ☐ **LK** Sri Lanka
- ☐ **LR** Liberia
- ☐ **LS** Lesotho .....
- ☐ **LT** Lithuania
- ☐ **LU** Luxembourg
- ☐ **LV** Latvia
- ☐ **MD** Republic of Moldova .....
- ☐ **MG** Madagascar .....
- ☐ **MK** The former Yugoslav Republic of Macedonia .....
- ☐ **MN** Mongolia
- ☐ **MW** Malawi .....
- ☐ **MX** Mexico .....
- ☐ **NO** Norway
- ☐ **NZ** New Zealand .....
- ☐ **PL** Poland .....
- ☐ **PT** Portugal .....
- ☐ **RO** Romania
- ☐ **RU** Russian Federation .....
- ☐ **SD** Sudan
- ☐ **SE** Sweden
- ☐ **SG** Singapore
- ☐ **SI** Slovenia .....
- ☐ **SK** Slovakia .....
- ☐ **SL** Sierra Leone .....
- ☐ **TJ** Tajikistan .....
- ☐ **TM** Turkmenistan .....
- ☐ **TR** Turkey .....
- ☐ **TT** Trinidad and Tobago .....
- ☐ **UA** Ukraine .....
- ☐ **UG** Uganda .....
- ☐ **US** United States of America .....
- ☐ **UZ** Uzbekistan .....
- ☐ **VN** Viet Nam .....
- ☐ **YU** Yugoslavia .....
- ☐ **ZA** South Africa .....
- ☐ **ZW** Zimbabwe .....

Check-boxes reserved for designating States which have become party to the PCT after issuance of this sheet:

- ☒ **DM** Dominica .....
- ☐ .....

Precautionary Designation Statement: In addition to the designations made above, the applicant also makes under Rule 4.9(b) all other designations which would be permitted under the PCT except any designation(s) indicated in the Supplemental Box as being excluded from the scope of this statement. The applicant declares that those additional designations are subject to confirmation and that any designation which is not confirmed before the expiration of 15 months from the priority date is to be regarded as withdrawn by the applicant at the expiration of that time limit. *(Confirmation of a designation consists of the filing of a notice specifying that designation and the payment of the designation and confirmation fees. Confirmation must reach the receiving Office within the 15-month time limit.)*

See Notes to the request form

Box No. VI PRIORITY CLAIM ☐ Further priority claim are indicated in the Supplemental Box.

Filing date of earlier application *(day/month/year)*	Number of earlier application	Where earlier application is: national application: country	regional application:* regional Office	international application: receiving Office
item (1) 18 September 1998	98307594.6		EP	
item (2)				
item (3)				

☐ The receiving Office is requested to prepare and transmit to the International Bureau a certified copy of the earlier application(s) *(only if the earlier application was filed with the Office which for the purposes of the present international application is the receiving Office)* identified above as item(s): _____

* *Where the earlier application is an ARIPO application, it is mandatory to indicate in the Supplemental Box at least one country party to the Paris Convention for the Protection of Industrial Property for which that earlier application was filed (Rule 4.10(b)(ii)). See Supplemental Box.*

Box No. VII INTERNATIONAL SEARCHING AUTHORITY

Choice of International Searching Authority (ISA) *(if two or more International Searching Authorities are competent to carry out the international search, indicate the Authority chosen; the two-letter code may be used)*: ISA / EP

Request to use results of earlier search; reference to that search *(if an earlier search has been carried out by or requested from the International Searching Authority)*:

Date *(day/month/year)*	Number	Country *(or regional Office)*
4 March 1999	98307594.6	EPO

Box No. VIII CHECK LIST; LANGUAGE OF FILING

This international application contains the following **number of sheets**:

request	:	6
description (excluding sequence listing part)	:	46
claims	:	8
abstract	:	1
drawings	:	35
sequence listing part of description	:	
Total number of sheets	:	96

This international application is **accompanied by** the item(s) marked below:

1. ☒ fee calculation sheet
2. ☐ separate signed power of attorney
3. ☐ copy of general power of attorney; reference number, if any:
4. ☐ statement explaining lack of signature
5. ☐ priority document(s) identified in Box No. VI as item(s):
6. ☐ translation of international application into (language):
7. ☐ separate indications concerning deposited microorganism or other biological material
8. ☐ nucleotide and/or amino acid sequence listing in computer readable form
9. ☒ other *(specify)*: Earlier Search Report

Figure of the drawings which should accompany the abstract: 31

Language of filing of the international application: English

Box No. IX SIGNATURE OF APPLICANT OR AGENT

Next to each signature, indicate the name of the person signing and the capacity in which the person signs (if such capacity is not obvious from reading the request).

LLOYD, PATRICK ALEXANDER DESMOND
25 AUGUST 1999

For receiving Office use only

1. Date of actual receipt of the purported international application:
2. Drawings: ☐ received: ☐ not received:
3. Corrected date of actual receipt due to later but timely received papers or drawings completing the purported international application:
4. Date of timely receipt of the required corrections under PCT Article 11(2):
5. International Searching Authority (if two or more are competent): ISA /
6. ☐ Transmittal of search copy delayed until search fee is paid.

For International Bureau use only

Date of receipt of the record copy by the International Bureau:

This sheet is not part of and does not count as a sheet of the international application.

PCT

FEE CALCULATION SHEET

Annex to the Request

For receiving Office use only

International application No.

Date stamp of the receiving Office

Applicant's or agent's file reference PADL/38884

Applicant

CALCULATION OF PRESCRIBED FEES

1. TRANSMITTAL FEE . . . . . £55 T
2. SEARCH FEE . . . . . £638 S

International search to be carried out by EP

(If two or more International Searching Authorities are competent in relation to the international application, indicate the name of the Authority which is chosen to carry out the international search.)

3. INTERNATIONAL FEE

Basic Fee

The international application contains 95 sheets.

first 30 sheets 285 b1

65 remaining sheets x 6 additional amount = 390 b2

Add amounts entered at b1 and b2 and enter total at B . . . . £675 B

Designation Fees

The international application contains ALL designations.

10 number of designation fees payable *(maximum 10)* x 65 amount of designation fee = £650 D

Add amounts entered at B and D and enter total at I . . . . . £1325 I

(Applicants from certain States are entitled to a reduction of 75% of the international fee. Where the applicant is (or all applicants are) so entitled, the total to be entered at I is 25% of the sum of the amounts entered at B and D.)

4. FEE FOR PRIORITY DOCUMENT *(if applicable)* . . . . . P

5. TOTAL FEES PAYABLE . . . . . £2018 TOTAL

Add amounts entered at T, S, I and P, and enter total in the TOTAL box

☐ The designation fees are not paid at this time.

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☒ cheque	☐ cash	☐ other *(specify)*:
☐ postal money order	☐ revenue stamps	

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The RO/ IIK

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☒ is hereby authorized to charge any deficiency or credit any overpayment in the total fees indicated above to my deposit account.

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D01631	25 August 1999	
Deposit Account No.	Date *(day/month/year)*	Signature

See Notes to the fee calculation sheet

P/C.

must be filed directly wi[redacted]ompetent International Preliminary Examining A[redacted]tyor, if two or more Authorities are competent, chosen by the applicant. The full name or two-letter code of that Authority may be indicated by the applicant on the line below:

PCT

CHAPTER II

DEMAND

under Article 31 of the Patent Cooperation Treaty:
The undersigned requests that the international application specified below be the subject of international preliminary examination according to the Patent Cooperation Treaty and hereby elects all eligible States (except where otherwise indicated).

For International Preliminary Examining Authority use only

Identification of IPEA	Date of receipt of DEMAND

Box No. I IDENTIFICATION OF THE INTERNATIONAL APPLICATION		Applicant's or agent's file reference
International application No. PCT/GB99/02863	International filing date *(day/month/year)* 1 September 1999	(Earliest) Priority date *(day/month/year)* 18 September 1998
Title of invention CIGARETTE MANUFACTURING MACHINE AND CONTROL SYSTEM THEREFOR		

Box No. II APPLICANT(S)

Name and address: *(Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country.)*	Telephone No.:
PHILIP MORRIS PRODUCTS INC. 3610 COMMERCE ROAD RICHMOND, VIRGINIA 23234 UNITED STATES OF AMERICA	Facsimile No.:
	Teleprinter No.:

State *(that is, country)* of nationality: US	State *(that is, country)* of residence: US

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State *(that is, country)* of nationality: UK	State *(that is, country)* of residence: UK

[X] Further applicants are indicated on a continuation sheet.

See Notes to the demand form

International application No.
PCT/GB99/02863

Continuation of Box No. II APPLICANT(S)

If none of the following sub-boxes is used, this sheet should not be included in the demand.

Name and address: *(Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country.)*

KEITH JOHN CADGE
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State *(that is, country)* of nationality:	State *(that is, country)* of residence:
UK	UK

[X] Further applicants are indicated on another continuation sheet.

See Notes to the demand form

International application No.
PCT/GB99/02863

Continuation of Box No. II APPLICANT(S)

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Name and address: *(Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country.)*

MALCOLM KENNETH SIMMS
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State *(that is, country)* of residence: UK

Name and address: *(Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country.)*

State *(that is, country)* of nationality:

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State *(that is, country)* of residence:

Name and address: *(Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country.)*

State *(that is, country)* of nationality:

State *(that is, country)* of residence:

☐ Further applicants are indicated on another continuation sheet.

See Notes to the demand form

International application No.
PCT/GB99/02863

Box No. III AGENT OR COMMON REPRESENTATIVE; OR ADDRESS FOR CORRESPONDENCE

The following person is [X] agent [ ] common representative

and [X] has been appointed earlier and represents the applicant(s) also for international preliminary examination.

[ ] is hereby appointed and any earlier appointment of (an) agent(s)/common representative is hereby revoked.

[ ] is hereby appointed, specifically for the procedure before the International Preliminary Examining Authority, in addition to the agent(s)/common representative appointed earlier.

Name and address: *(Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country.)*

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Teleprinter No.:
25445

[ ] **Address for correspondence:** Mark this check-box where no agent or common representative is/has been appointed and the space above is used instead to indicate a special address to which correspondence should be sent.

Box No. IV BASIS FOR INTERNATIONAL PRELIMINARY EXAMINATION

Statement concerning amendments:*

1. The applicant wishes the international preliminary examination to start on the basis of:

[X] the international application as originally filed

the description
[ ] as originally filed
[ ] as amended under Article 34

the claims
[ ] as originally filed
[ ] as amended under Article 19 (together with any accompanying statement)
[ ] as amended under Article 34

the drawings
[ ] as originally filed
[ ] as amended under Article 34

2. [ ] The applicant wishes any amendment to the claims under Article 19 to be considered as reversed.

3. [ ] The applicant wishes the start of the international preliminary examination to be postponed until the expiration of 20 months from the priority date unless the International Preliminary Examining Authority receives a copy of any amendments made under Article 19 or a notice from the applicant that he does not wish to make such amendments (Rule 69.1(d)). *(This check-box may be marked only where the time limit under Article 19 has not yet expired.)*

* Where no check-box is marked, international preliminary examination will start on the basis of the international application as originally filed or, where a copy of amendments to the claims under Article 19 and/or amendments of the international application under Article 34 are received by the International Preliminary Examining Authority before it has begun to draw up a written opinion or the international preliminary examination report, as so amended.

Language for the purposes of international preliminary examination: ENGLISH

[X] which is the language in which the international application was filed.
[ ] which is the language of a translation furnished for the purposes of international search.
[ ] which is the language of publication of the international application.
[ ] which is the language of the translation (to be) furnished for the purposes of international preliminary examination.

Box No. V ELECTION OF STATES

The applicant hereby elects all eligible States *(that is, all States which have been designated and which are bound by Chapter II of the PCT)*

excluding the following States which the applicant wishes not to elect:

See Notes to the demand form

Sheet No. .5.

International application No.
PCT/GB99/02863

Box No. VI CHECK LIST

The demand is accompanied by the following elements, in the language referred to in Box No. IV, for the purposes of international preliminary examination:			For International Preliminary Examining Authority use only: received	not received
1. translation of international application	:	sheets	☐	☐
2. amendments under Article 34	:	sheets	☐	☐
3. copy (or, where required, translation) of amendments under Article 19	:	sheets	☐	☐
4. copy (or, where required, translation) of statement under Article 19	:	sheets	☐	☐
5. letter	:	1 sheets	☐	☐
6. other *(specify)*	:	sheets	☐	☐

The demand is also accompanied by the item(s) marked below:

1. [X] fee calculation sheet
2. [ ] separate signed power of attorney
3. [ ] copy of general power of attorney; reference number, if any:
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5. [ ] nucleotide and or amino acid sequence listing in computer readable form
6. [ ] other *(specify)*:

Box No. VII SIGNATURE OF APPLICANT, AGENT OR COMMON REPRESENTATIVE

Next to each signature, indicate the name of the person signing and the capacity in which the person signs (if such capacity is not obvious from reading the demand).

PATRICK A D LLOYD

20 JANUARY 2000

For International Preliminary Examining Authority use only

1. Date of actual receipt of DEMAND:
2. Adjusted date of receipt of demand due to CORRECTIONS under Rule 60.1(b):
3. [ ] The date of receipt of the demand is AFTER the expiration of 19 months from the priority date and item 4 or 5, below, does not apply. [ ] The applicant has been informed accordingly.
4. [ ] The date of receipt of the demand is WITHIN the period of 19 months from the priority date as extended by virtue of Rule 80.5.
5. [ ] Although the date of receipt of the demand is after the expiration of 19 months from the priority date, the delay in arrival is EXCUSED pursuant to Rule 82.

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Demand received from IPEA on:

CHAPTER II

PCT

FEE CALCULATION SHEET

Annex to the Demand for international preliminary examination

International application No. PCT/GB99/02863	For International Preliminary Examining Authority use only
Applicant's or agent's file reference PADL/38884	Date stamp of the IPEA

Applicant

PHILIP MORRIS PRODUCTS ET AL.

Calculation of prescribed fees

1. Preliminary examination fee	E 1,533	P
2. Handling fee *(Applicants from certain States are entitled to a reduction of 75% of the handling fee. Where the applicant is (or all applicants are) so entitled, the amount to be entered at H is 25% of the handling fee.)*	E 147	H
3. Total of prescribed fees Add the amounts entered at P and H and enter total in the TOTAL box	E 1,680	TOTAL

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Deposit Account Number	Date *(day/month/year)*	Signature

See Notes to the fee calculation sheet

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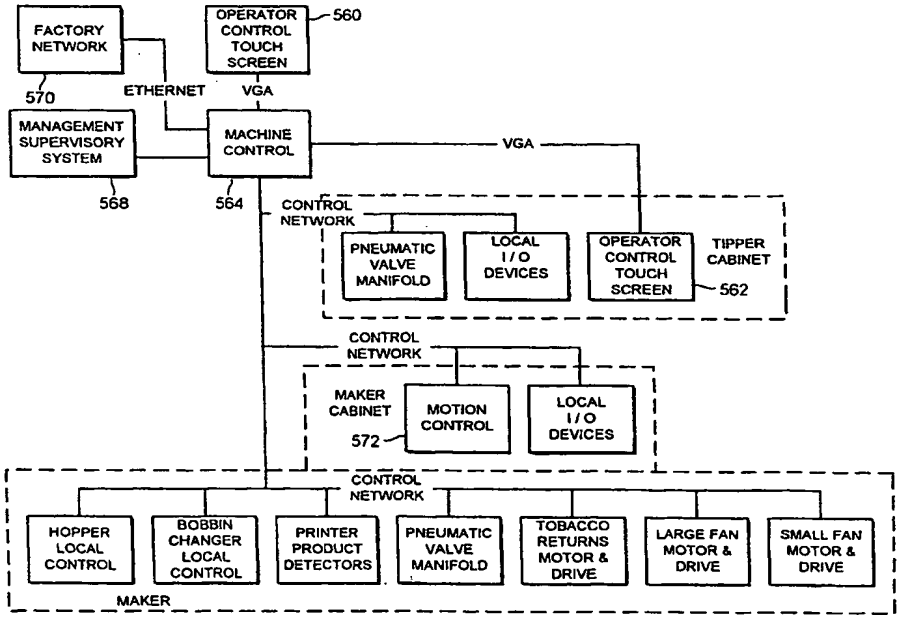
(81) Designated States: AE, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CR, CU, CZ, DE, DK, DM, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, UA, UG, US, UZ, VN, YU, ZA, ZW, ARIPO patent (GH, GM, KE, LS, MW, SD, SL, SZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).

Published
With international search report.

(54) Title: CIGARETTE MANUFACTURING MACHINE AND CONTROL SYSTEM THEREFOR

(57) Abstract

A cigarette manufacturing apparatus comprises a tobacco rod maker for making double length tobacco rods, a tipper for applying filters to tobacco rods to form filter tipped cigarettes, and a transfer apparatus for transferring double length tobacco rods from the rod maker to the tipper. Each of the tipper and the rod maker comprises a plurality of field devices for monitoring and/or affecting parameters of the rod maker, the tipper or the cigarettes being manufactured. A motion controller controls a plurality of synchronised motors. A PC based controller controls the motion controller, the devices on the tipper and the rod maker and communicates with an HMI which is running on the same or a separate PC. The devices and the controller are linked by a field bus. The HMI PC and the motion controller are connected to the system controller either over their own links or via the fieldbus.



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CIGARETTE MANUFACTURING MACHINE AND CONTROL SYSTEM THEREFOR

This invention relates to the manufacture of filter cigarettes and to control systems for controlling the cigarette rod making and filter tipping machines.

Cigarette rod making machines and filter tippers are well known. Commonly, cigarette rods made by a rod maker are passed automatically to a filter tipper over a transfer apparatus. The filter tipper adds a filter to the cigarette rod and wraps tipping paper around the combination. The finished cigarettes are then passed to a packaging station.

More recently, production speeds have been increased by manufacturing double length cigarette rods. These double length rods are transferred to the tipper as a whole. As part of the transfer process, the cigarette rod is split at its mid-point, the two single rod lengths separated and a double length filter inserted between the separated rod length. Tipping paper is wrapped around the whole and the filter is then cut at its mid-point to produce two completed cigarettes. As these cigarettes are arranged in the tipper in opposite directions, one of the cigarettes is then rotated before the completed product is passed to the packaging machine.

Traditionally, cigarette manufacturing machines have been essentially mechanically driven and controlled. The various motion/rotating devices in the machines are driven through appropriate gear boxes from a main drive. In recent years there has been a move to replacing some of this bulky drive train with a series of independent servo motors which are synchronized with one another.

We have appreciated that there are many aspects of the cigarette production process which are not controlled adequately by existing machinery.

The present invention aims to address the above-mentioned deficiencies in the prior art.

According to the invention there is provided a cigarette manufacturing apparatus comprising: a tobacco rod maker for making double length tobacco rods; a tipper for applying filters to tobacco rods to form filter tipped cigarettes; a transfer apparatus for transferring double length tobacco rods from the rod maker to the tipper; wherein each of the tipper and the rod maker comprises a plurality of devices for monitoring and/or affecting parameters of the rod maker, the tipper or the cigarettes being manufactured; a controller for controlling the plurality of devices on the tipper and the rod maker; and a field bus, the plurality of devices and the controller being connected to the field bus.

The invention also provides a cigarette manufacturing apparatus comprising: a tobacco rod maker for making double length tobacco rods; a tipper for applying filters to tobacco rods to form filter tipped cigarettes; a transfer apparatus for transferring double length tobacco rods from the rod maker to the tipper; wherein each of the tipper and the rod maker comprises a plurality of devices for monitoring and/or affecting parameters of the rod maker, the tipper or the cigarettes being manufactured; a first controller for controlling the plurality of devices on the tipper and the rod maker; and a second controller for providing tipper, rod maker and cigarette information to an operator and for communicating input data from the user to the first controller.

The invention further provides a cigarette manufacturing apparatus comprising: a tobacco rod maker for making double length tobacco rods; a tipper for applying filters to tobacco rods to form filter tipped cigarettes; a transfer apparatus for transferring double length tobacco rods from the rod maker to the tipper; a plurality of synchronised servo motors each for driving a respective operation in the tipper or the rod maker; wherein each of the tipper and the rod maker further includes a plurality of devices for monitoring and/or

affecting parameters of the rod maker, the tipper or the cigarettes being manufactured; a motion control device for controlling the plurality of synchronised motors; a system controller for controlling the plurality of devices on the tipper and the rod maker, the motion control device being connected to the system controller; and a field bus, the plurality of devices and the controller each being connected to the communications network.

In one embodiment of the invention it is preferred that the synchronised motors are servo motors. Preferably, the communications network is a field bus-type network.

The invention also provides a cigarette manufacturing apparatus comprising: a tobacco rod maker for making double length tobacco rods; a tipper for applying filters to tobacco rods to form filter tipped cigarettes; a transfer apparatus for transferring double length tobacco rods from the rod maker to the tipper; wherein each of the tipper and the rod maker comprises a plurality of devices for monitoring and/or affecting parameters of the rod maker, the tipper or the cigarettes being manufactured; a control network, the plurality of devices being coupled to the control network; a first controller connected to the control network for controlling the plurality of devices on the tipper and the rod maker; and a second controller coupled to the first controller and including at least one HMI for providing tipper, rod maker and cigarette information to an operator and for communicating input data from the user to the first controller.

The invention also provides a method of controlling the manufacture of cigarettes by an apparatus comprising a tobacco rod maker and tipper interconnected by a rod transfer apparatus, the method comprising the steps of: providing a field bus and a machine controller connected to the field bus; connecting a plurality of devices to the field bus, for monitoring and/or affecting parameters of the rod maker, the tipper or the cigarettes being

manufactured; monitoring the field bus from the controller for data from the devices; and adjusting one or more parameters of the tipper or rod maker in accordance with the information content of the data received.

Embodiments of the invention have the advantage that the entire cigarette manufacturing process is controlled as a whole. In the prior art, the rod makers and the filter tippers are controlled individually which we have appreciated is undesirable. Preferably, devices to be controlled in both the rod maker and the tipper are all linked on a common field bus which is controlled by a common controller. This has the advantage that machine wiring is minimised yet permits improved communication between devices on the fieldbus and the controller.

Preferably, both the tipper and the rod maker have human machine interfaces (HMI's) which can receive data from and send data to the fieldbus via the controller. Preferably, the HMIs are controlled by a different controller from the devices on the field bus. The control data may be accessed, for example, through a TCP/IP link to a factory local area network (LAN) or beyond enabling remote diagnostics. The separation of the data ensures that the integrity of the manufacturing process can not be compromised, for example through unauthorised users on the LAN.

Embodiments of the invention have the advantage that production speeds may be greatly increased. Embodiments of the invention have the advantage that many adjustments may be made to the machine without stopping production which would hitherto have required substantial down times. For example, the phasing of the maker to the tipper. When ramping up to full speed the phasing can be changed during ramp-up to give a higher quality cigarette during this time. In addition the ratio of the garniture belt to the suction tape can be varied to allow different brands having different parameters to be manufactured without

stopping the machine. The position of the manufacturer's print information on the cigarettes can be varied according to defined parameters as can the position of the densed end in the tobacco rod. This facilitates a switch of production to a different brand with different brand specifications. By eliminating the majority of the mechanical linkages and replacing these with intelligent devices such as intelligent servomotors, and distributed control, quieter operating may be achieved which is beneficial to users of the machinery.

Embodiments of the invention have the additional advantage that there is a greater mean time between failures and, in the event of failures, there is a smaller mean time to repair. The mean time to repair is partly reduced by the presence of the HMI which has access to diagnostic data from devices on the field bus enabling quick fault diagnosis and quick identification of faulty components for replacement. In addition, diagnosis may be made from a remote site, for example over the factory business LAN or Intranet.

An embodiment of the invention will now be described, by way of example only, and with reference to the accompanying drawings in which:

Figure 1 is a schematic view of a front end of a cigarette rod maker showing the hopper arrangement of drums and rollers which transfer tobacco to the suction chamber;

Figures 2 and 3 show schematically a hopper suitable for use in the cigarette rod maker of figure 1;

Figure 4 shows schematically one embodiment of a roller for use in the hopper of figures 2 and 3;

Figure 5 is a schematic view of the suction chamber showing apparatus for controlling the rod density;

Figure 6 is a schematic cross section of the apparatus of figure 5 on the line 6-6 in figure 5;

Figure 7 is a detailed view of one embodiment of part of the apparatus of figure 5;

Figure 8 is an exploded view of the apparatus of figure 7;

Figure 9 is a detailed cross sectional view of a second embodiment of the apparatus of figure 5;

Figure 10 is a schematic view of the maker from the suction band to ejection of completed double length rods;

Figure 11 is a perspective view of a transfer apparatus showing a kicker used to transfer rods from the rod maker;

Figure 12 is an enlarged view of a portion of the apparatus of figure 11;

Figure 13 is a plan of the kicker assembly of figure 11;

Figure 14 is a front view of the assembly of figure 13;

Figure 15 is a plan of the kicker wheel;

Figure 16 is a front view of the kicker wheel;

Figure 17 is a section A-A of figure 16;

Figure 18 is a plan of the suction housing;

Figure 19 is a front view of the suction housing;

Figure 20 is a rear view of the suction housing;

Figure 21 is a schematic view of the drum assembly of the transfer apparatus of the cigarette manufacturing machine embodying the inventions;

Figure 22 is a rear perspective view of a transfer apparatus with the cover removed;

Figure 23 is an exploded view of parts of the transfer apparatus;

Figure 24 is a perspective view of the receiving drum of the transfer apparatus;

Figure 25 is a perspective view of the suction housing for the receiving drum;

Figure 26 is a perspective view of the tipper;

Figure 27 is a front schematic perspective view of the rodmaker with the positions of certain motors shown;

Figure 28 is a rear schematic perspective view of the rodmaker with the positions of certain motors shown;

Figure 29 is a rear perspective view of the tipper with the positions of certain motors shown;

Figure 30 is a schematic view of a first embodiment of the control system for the tipper and rod manufacture showing the field bus;

Figure 31 is a schematic view of a second embodiment of the control system for the tipper and rod manufacture showing the field bus;

Figure 32 is a view of the main menu displayed on the tipper HMI;

Figure 33 is a view of the prepare maker screen displayed on the maker HMI;

Figure 34 is a view of the parameter adjust screen displayed on the maker HMI;

Figure 35 is a view of the phase shift screen displayed on the maker HMI;

Figure 36 is a view of the prepare tipper screen displayed on the tipper HMI;

Figure 37 is an overview of the relationship between various screens displayable on the tipper and maker HMIs;

Figure 38 is a flow chart indicating the major steps in the control process;

Figure 39 is a flow chart of showing the steps in the general start up routine;

Figure 40 is a flow chart showing the steps in the tipper start up routine; and

Figure 41 is a flow chart showing the steps in the maker start up routine.

The basic operation of the cigarette rod making machine and the tipper will first be described.

The cigarette rod making machine manufactures double length cigarette rods and transfers these to a tipper which further cuts the double rods and inserts a double length filter between the rods. Tipping paper is then applied and the finished cigarette pairs are severed, alternately re-oriented, tested and sent for further processing.

Figure 1 shows, schematically, the front end of a tobacco rod maker. This is only one example of the front end of the maker and other front ends may be used. Cut tobacco is fed initially into the back of a hopper 10. A top mesh drum 1, which has a vacuum drawn through it, carries the tobacco to a paddle wheel 2 which closes the hopper well. A sensor 3 in the hopper well detects whether there is a sufficient quantity of tobacco in the hopper. The vacuum to the mesh drum 1 is turned off when the hopper sensor 3 is covered by tobacco and is switched on when the sensor becomes uncovered. A guard door 4 is provided at the top of the hopper through which tobacco recovered from spillages etc. may be added. A tamper plate 5 is fitted in the hopper well which is pushed into the well at regular intervals to stop the tobacco from becoming compacted. A permanent magnet 6 is fitted under the paddle wheel 2 to remove any ferrous material from the tobacco stream.

The hopper may be of purely conventional design as shown in figure 1 or, modified as shown in figures 2 to 4. In the hopper of figure 2, a spiked metering roller 7 located at the bottom of the hopper well carries the tobacco from the hopper dropping it in the area behind a pair of carded drums 8,9 which will be described in due course.

In the hopper of figures 2 to 4, a delivery roller 12 is disposed across the inlet of the hopper. The circumferential surface of the roller 12 has spikes 14 to engage with tobacco entering the hopper. In one embodiment of the machine the roller 12 is mounted on a

driven shaft 16 and comprises four separate roller sections 12a,b,c,d. At the bottom of the hopper the two rotatable carded drums 8 (only one drum is shown) are disposed. Between the level of the delivery roller 12 and the carded drum 8, in a location corresponding to the desired maximum level of tobacco in the hopper, a generally horizontal row of four photo sensitive cells 20a,b,c,d is disposed. Each cell 20a,b,c,d is connected to an actuator for a respective roller section 12a,b,c,d, and each cell is at a point in the hopper wall vertically below the projection of the respective roller section onto the hopper side wall.

In use, tobacco enters the hopper 10 from above. All the delivery roller sections 12a,b,c,d rotate to distribute incoming tobacco onto the rotating carded drum 18 which forms the floor of the hopper. This situation, shown in figure 2, obtains so long as the level of tobacco in the hopper remains below the level of all the photo sensitive cells 20a,b,c,d. Figure 3 shows a hopper 10 in which the level of tobacco 22 has risen to the desired maximum level adjacent two cells 20b,d. Activation of these cells by the tobacco causes them to send a signal which disengages the respective roller sections 12b,d, which causes less tobacco to be distributed to the regions of the hopper 10 covered by the activated photo sensitive cells 20b,d.

Once the level of tobacco has fallen below the level of the activated photo sensitive cells, the disengaged roller sections are reengaged and rotate, distributing tobacco to those regions once more. If desired, re-engagement of roller sections may be delayed for a fixed time after the respective photo sensitive cell is deactivated, allowing the level of tobacco in the region monitored by the activated cell to drop below the desired maximum.

The signal sent by a photo sensitive cell on activation can cause the respective roller section to

engage the driven shaft in any of several ways. For example, the signal can cause an electromagnetic clutch within the roller section to engage the driven shaft, causing the roller section to rotate. Alternatively, the signal can cause a solenoid to move a key in one of the shaft or the roller section into a keyway in the other; the relative rotation of the driven shaft and the unengaged roller section will bring the key and keyway into opposition so that engagement takes place.

Figure 4 shows a pneumatic clutch arrangement. A delivery roller 12 comprises four roller sections 12a,b,c,d (the spikes of the roller are not shown). The driven shaft 16 on which the roller 12 is mounted has passageways 24a,b,c,d each of which opens in the circumferential wall of the shaft 16 away from the roller 12 and each of which ends in an actuator chamber 26a,b,c,d which opens in the circumferential wall of the shaft 16 adjacent a respective one of the roller sections 12a,b,c,d. Each actuator chamber 26a,b,c,d houses a friction block 28a,b,c,d which engages sealingly with the side walls of the chamber 26a,b,c,d but is free to move in the chamber toward and away from the respective roller section 12a,b,c,d. In the embodiment shown, two of the channels 24a,b open in the circumferential wall of the shaft 16 to one side of the roller 12 and two to the other side.

A source of compressed air (not shown) is connected to each of the passageways 24a,b,c,d by air supply pipes 30a,b,c,d. The supply pipes 30a,b,c,d are connected to the passageways 24a,b,c,d in such a manner that the shaft 16 can rotate without rotation of the supply pipes. The connection may be such that each supply pipe 30a,b,c,d is in constant communication with a respective passageway 24a,b,c,d throughout a revolution of the shaft 16. This can be achieved by providing a plenum block 32 circumferentially around the shaft 16 through which the air supply pipes 30a,b,c,d pass. The ends of the supply

pipes adjacent the shaft each end in a respective circumferential plenum chamber 34a,b,c,d, each of which is in constant communication with the respective passageway 24a,b,c,d as the shaft rotates. Alternatively it can be that the communication is broken as the shaft rotates, the open ends of the channels being sealed during the rest of the revolution of the shaft by means not shown such as sealing blocks extending circumferentially around the shaft 16 through which the air supply pipes 30a,b,c,d pass.

In use, when no signal is received from one of the sensors 20a, indicating an acceptable level of tobacco in the part of the hopper covered by that sensor, a valve (not shown) in the respective air supply pipe 30a is open admitting air under pressure into the circumferential plenum chamber 34a in the plenum block 32 and thence into the respective passageway 24a in the rotating shaft 16 and the actuator chamber 26a at the other end of the passageway 24a. The raised air pressure in the actuator chamber 26a urges the friction block 28a in the actuator chamber 26a against the wall of the respective roller section 12a, causing it to rotate with the shaft 16.

If the sensor 20a sends a signal indicating a build up of tobacco in the part of the hopper covered by that sensor, the valve in the air supply pipe 30a closes. The air pressure in the actuation chamber 26a returns to atmospheric as air leaks out of the passageway 24a, so that the friction block 28a is no longer urged against the wall of the roller section 12a, thus disengaging that roller section from the shaft 16 so that the roller section stops rotating. It will be appreciated that the other roller sections 12b,c,d are disengaged and engaged in the same way in response to a signal or the lack of a signal from the respective sensors 20b,c,d in the hopper.

The signal from the activated cell can pass through a processing device which then sends a signal to the respective roller section. It will also be appreciated

that the cell may be activated to send a signal when it is not detecting tobacco, and cease to send the signal or send a different signal when it detects tobacco.

Referring back to figure 1, the tobacco metering roller 7 draws tobacco from the hopper 10 creating a constant head. The metering roller 7 is controlled by three photo electric sensors (PECs)36,37,38 which are arranged the such that the metering roller speed is increased if any of the three sensors cannot see tobacco, so ensuring a constant head.

From the metering roller 7, tobacco is passed between the carded drum rollers . The upper of those rollers 8 is a small carded drum and the lower a large carded drum 9. The lower, large, carded drum 9 picks up the tobacco and carries round until it meets the small carded drum 8. These drums rotate relatively slowly and are synchronised to the main drive. The gap between the two carded drums allows a uniform quantity of tobacco to pass through. Excess tobacco is formed into a roll by the contra-rotation of the two carded drums. The tobacco is then passed to a pair of picker and winnower rollers 41, 42 which rotate at a relatively high speed and throw the tobacco into an air stream to transport it to an suction band. The picker roller operates by picking tobacco from the large carded drum 9 and passing it under the winnower roller 41 which accelerates the tobacco to a perforated rotating collector tube 43. Suction passing through the collector tube 43 picks up the tobacco and carries it round into the airstream passing up a chimney 44. Air from a small fan is blown up a scroll 45 fitted under the collector tube which blows the strands of tobacco up the chimney. Heavier particles of tobacco, stem and birdseye fall through the airstream into the stem collector 46. Air is also sucked up the chimney by a large fan which pulls the strands up to a perforated band. The velocity of the air can be altered by reducing

the air flow entering the chimney. The velocity of the airflow is altered to suit the product being used.

The hopper section has a synchronised drive controlling the large carded drum and a variable speed drive controlling the tobacco metering roller or delivery bands, which can have a variable set point dependent on the machine speed.

The tobacco passed up the chimney is held on the underside of a suction band which carries it forward to a garniture. The depth of tobacco held on the band is trimmed by ecreteur discs to the correct depth.

Referring to figures 5 to 9, an endless suction band 47 passes longitudinally through the chamber 40 in the direction shown by the large arrow in figure 5. The suction band 47 is preferably driven by a servomotor synchronised with the other motor drives and is permeable to air but substantially impermeable to tobacco. Alternatively it may be mechanically linked. The chamber 40 has a top wall 49, a bottom wall 49', side walls 50,50', and end walls 48,48'. The bottom wall 49' extends from the downstream end wall 48' of the chamber 40 toward the upstream end wall 48, but stops short. A downwardly extending wall 51 depends from the upstream edge of the bottom wall 49' and defines together with a downward extension 52 of the upstream end wall 48 of the chamber, a chimney 54 through which tobacco is introduced into the chamber. The side walls 50,50' are substantially parallel to the longitudinal axis of the chamber 40. The end walls 48,48' are substantially transverse to the longitudinal axis of the chamber 40. The suction band 47 enters the chamber 40 through an entry port 56 in the end wall 48 and leaves the chamber 40 through an exit port 56' in the end wall 48'. A fan (not shown) is provided to draw air through the chimney 54 and the suction chamber 40; tobacco is fed to the chimney and entrained in the air.

A rotary stepper motor 58, which includes a gearbox, is disposed outside the suction chamber 40 and attached to a side wall 50 of the chamber 40. The spindle 60 of the motor 58 passes through a hole 62 in the wall 50 of the chamber 40. The motor 58 is attached to the wall 50 of the chamber 40 so that the spindle 60 is free to rotate and so that no oil leaks from the motor 58 into the suction chamber 40 through the hole 62. The free end 64 of the spindle 60 is in the chamber 40 above the suction band 47 and above the bottom wall 49'. The free end 64 of the spindle is connected to the mounting end 66 of a finger 68 extending radially outward of the spindle. The free end 70 of the finger 68 contacts the upper surface of the suction band 47. An ecreteur 72 is situated below the suction band 47 and after the end 70 of the finger 68. A density determining means downstream of the suction chamber 70 determines the density of newly made tobacco rods (not shown) by a conventional beam attenuation method and sends a control signal to a weight control computer and thence to the motor 58.

Figure 7 shows in detail a first embodiment of the finger 68 and the motor 58. Figure 8 is an exploded view of the components of the finger 68 and the motor 58 of the embodiment illustrated in figure 7.

The free end of the finger 68 defines a segment of a circle so that the surface of the finger 68 that contacts the band 47 is curved. This finger shape has been found to prolong the life of the suction band 47. Preferably, the surface of the finger 68 that contacts the band 47 is hardened or has a hard insert. More preferably the surface of the finger 68 that contacts the suction band 47 is nitrided or coated with tungsten carbide or ceramic.

The finger 68 is mounted on the motor spindle 64 by a bolt 74 passing through an open ring 76 at the mounting end 66 of the finger. A tolerance ring 78 fits between the open ring 76 and a housing 80 by which the motor 58

is attached to the wall 50 of the suction chamber 40. An O-ring seal 82 between the housing 80 and the chamber wall 50 prevents air or tobacco passing between the housing and the chamber wall. A U-cup seal 84 between the motor spindle 60 and the housing 80 prevents oil leaking from the motor 58 into the chamber 40 and prevents tobacco entering the motor 58. Screws 86 attach the motor 58 to the housing 80. Screws 88 attach the housing 80 to the wall 50 of the chamber 40. A reference point sensor (not shown) is disposed above the finger 68 and an over rotation sensor (not shown) below the finger 68.

The motor may be of any type but is preferably a stepper motor or other proportional actuator device such as a solenoid actuator or LVD device.

Figure 9 shows in detail a second embodiment which is similar to the embodiment of figures 7 and 8 but in which the finger 68 is coupled to the motor 58 and gearbox by an extension shaft 90. An end 92 of the extension shaft 90 is hollow and accommodates the spindle 60 of the motor 58. The extension shaft is attached to the motor spindle 60 and extends from it towards the wall 50' of the chamber 40. The other end 94 of the extension shaft 90 passes through the open ring 76 at the mounting end 66 of the finger 68. A cap 96 fits over the end 94 of the extension shaft 90 and abuts the mounting end 66 of the finger 68. The cap 96 is attached to the extension shaft 90 by a screw 98 that passes through the cap 96 and into the end 94 of the extension shaft 90. The cap 96 ensures that the finger is retained on the extension shaft 90. In this embodiment, the housing 80 of the motor 58 extends into the chamber 40 through the hole 62 in the wall 50 towards the other wall 50' to form a hollow cylindrical sheath 100. The extension shaft 90 passes through, and extends beyond the hollow cylindrical sheath 100. The distal end 102 of the hollow cylindrical sheath 100 (relative to the motor 58) is adjacent to a

tolerance ring 104 mounted on the extension shaft. The tolerance ring 104 seals the gap between the distal end 102 of the hollow cylindrical sheath 100 and the mounting end 66 of the finger 68.

As in the first embodiment, the O-ring seal 82 prevents air or tobacco passing between the housing 80 and the chamber wall 50. A U-cup seal 106 between the extension shaft and the hollow cylindrical sheath prevents oil leaking from the motor 58 into the chamber 40 and prevents tobacco entering the motor 58. It will be appreciated that the motor spindle and the extension shaft are protected from the abrasive effect of tobacco by the hollow cylindrical sheath 100, the tolerance ring 104, the mounting end 66 of the finger 68, and the cap 96 which together cover the motor spindle 60 and the extension shaft 90.

In use, the suction band 47 is driven by the synchronised servomotor unidirectionally so that it moves relative to the suction chamber 40 in a direction parallel to the longitudinal axis of the chamber in the direction shown by the large arrow in figure 5. As the suction band 47 is driven, air is drawn into the suction chamber 40, by means not shown, through the chimney 54. Tobacco (not shown) entrained in the air is drawn onto the suction band 47 upstream of the bottom wall 49'. Excess tobacco drawn onto the suction band 47 is removed by the ecreteur 72 driven by a synchronised servo motor. Tobacco remaining on the suction band 47 after trimming is formed into a continuous tobacco rod. The density determining means measures the density of tobacco in the newly made tobacco rod by the conventional beam attenuation method. If the density of the newly made tobacco rod is too high, the density determining means sends a signal to the motor 58 and causes the motor 58 to rotate the spindle 60 clockwise (as the spindle is viewed along its axis towards the motor 58). Rotation of the spindle 60 causes the finger 68 to rotate and the free

end 70 of the finger 68 to move clockwise (viewed as before). Clockwise movement of the free end 70 of the finger 68 causes it to move downwards towards the ecreteur 72. As the end 70 of the finger 68 moves towards the ecreteur 72, the suction band 47 moves towards the ecreteur 72. Movement of the suction band 47 towards the ecreteur 72 increases the amount of tobacco cut away by the ecreteur 72. Consequently, less tobacco remains on the suction band 47 than before and less tobacco is delivered by the suction band 47 to make the tobacco rod, which is thus less dense.

If the density of the tobacco rod is too low, the density determining means sends a signal to the motor 58 and causes the motor 58 to rotate the spindle 60 anticlockwise (as the spindle 60 is viewed along its axis towards the motor 58). Anticlockwise movement of the end 70 of the finger 68 causes it to move upwards away from the ecreteur 72. As the end 70 of the finger 68 moves away from the ecreteur 72 the suction band 47 remains in contact with the finger 68 and moves away from the ecreteur 72. Movement of the suction band 47 away from the ecreteur 72 reduces the amount of tobacco cut away by the ecreteur 72. Consequently, more tobacco remains on the band 47 than before and more tobacco is delivered by the band 47 to the tobacco rod, which is thus denser. The continuous tobacco rod is cut into double length tobacco rods.

Each time the apparatus is switched on, the finger 68 is set to a reference position sensed by the reference point sensor. The reference position is chosen so that the amount of excess tobacco removed from the suction band by the ecreteur is approximately correct. If the finger rotates too far towards the ecreteur, the over rotation sensor sends a signal to the motor 58 which then resets the position of the finger 68 to the reference position. The finger is prevented, therefore, from operating for prolonged periods in the wrong position.

Referring now to figure 10, the linear speed of the suction band 47 is defined by the length of the tobacco rod of the cigarette to be made and the production rate of cigarettes. The densed end is formed just before trimming, this is done by a single rotating cam that compresses tobacco in the stream.

The cam 110 rotates at one revolution per two linear cigarette lengths of travel along the suction band. The ecreteur or trimming discs 112 are set so that their peripheral speed is slightly greater than the linear rod speed and the height of the tobacco stream with respect to the trimmer discs 112 is controlled by the weight control unit (not shown). Trimmed tobacco is returned to the hopper by, for example, a spiral screw and shaker tray transport mechanism.

The trimmed tobacco, with formed densed ends is then passed to a garniture 114 where the tobacco rod is made up. The garniture includes a belt driven by a synchronised servomotor which draws wrapping paper 116 from a bobbin. The stream of tobacco is deposited on this paper and the rod is formed by the shape of the garniture which wraps the paper around the tobacco stream. Adhesive from a reservoir is applied to the edge of the paper by an applicator nozzle 118, the adhesive is set by passing the rod under a temperature controlled heater bar 120. At this point, the machine is making a continuous cigarette rod with densed ends at either one tobacco or two tobacco lengths along it.

The cigarette wrapping paper fed into the garniture is drawn off the bobbin by a pair of pinch rollers. The average linear speed of the paper must equal the linear speed of the garniture belt. However, when a bobbin is exhausted it is necessary to stop the paper to splice automatically the next paper bobbin. To achieve this, the bobbin speed is increased before the splice to fill a paper reservoir to enable constant running of the rod maker during the splice operation. After the splice, the

bobbin speed is increased gradually to a linear speed just below garniture speed to exhaust the paper reservoir. When the reservoir is exhausted the paper speed will be increased until it again equals the garniture speed. The bobbin drive may be an independent servo drive which receives machine speed signals from the master axis drive on the machine and uses a further signal from a dancing arm to apply speed correction by sensing paper tension.

The cigarette paper is then passed through a printer on its way from the bobbin to the garniture at which stage manufacturer's information such as brand name is printed by a print wheel on the cigarette. The print wheel may have four impressions and is therefore controlled to rotate once every four rod lengths. The printer may have its own synchronised servo motor. This permits the print position to be advanced or retarded, to improve quality, not by changing the length of the paper run, as is done conventionally, but by changing the phase between the printer and garniture tape servo motors through software parameters.

The finished continuous rod is then passed to a knife cut-off unit 124 which includes a knife blade mounted on the periphery of a rotating drum. The drum is driven by a servo motor to which the linear drive speed is synchronised such that drum rotates once every two cigarette rod lengths so as to cut the rod stream into double length rods. It is essential that the cut is through the centre of the densed end. Thus, there is an exact relationship between the garniture belt drive, the dense end cam and the knife, both in relative speed and position.

The rod must be running at a constant speed with respect to the cutter otherwise the cigarette length will vary. However, as the cigarette length may vary, from brand to brand, changing the rod length is achieved by

changing software parameters which define the speed and position relationships of the respective servo drives.

The cutter includes a mechanical sharpening and deburring system to keep the knife blade sharp after each revolution. A knife advance mechanism maintains knife position replacing lost knife material during grinding and deburring operations.

The continuous rod is supported during the cutting operation by a conventional ledger 126.

Before the cut, the tobacco rods are passed through a nucleonic or other density measuring device 122. The rod density is measured electronically and any deviation from pre-determined limits will cause the band above the ecreteur discs to be raised or lowered accordingly. The rods then pass a sensor which causes the first few rods of a run to be ejected to maintain quality control. The rods then pass to a kicker wheel which accelerates the rods to a transfer apparatus for transfer to the tipper. The kicker rotates once per two cut lengths (that is per two double length rods) and its diameter is such that the rotational speed of the periphery is higher than the linear rod speed to achieve the acceleration. The kicker, shown in figures 11 to 20, picks the rods off the rail and transfers them to the receiving drum of the transfer apparatus. The kicker shown in figures 11 and 12 is a helical kicker and the kicker shown in figures 13 to 20 is an in-line kicker. Either may be used.

The receiving drum has a cover and receives rods from the kicker at high speed. The rods are received in flutes on the drum and decelerated and held by a series of suction holes along the length of the flutes. The flutes have flared ends to make it easier for the rods to be received from the kicker in the flutes.

The kicker assembly comprises a main housing 200 which is mounted on the rod maker. At an end of the housing is a drive 210 which is driven from the rod maker drive via a shaft at the far end of the housing (not

shown) through a timex pulley and belt (not shown). The drive transfers drive via a drive belt 212 to a second, kicker shaft 214. Both the drive shaft and the kicker shaft have toothed belt wheels 116 on which the drive belt is mounted. The belt 212 is retained inside a belt housing 218 to which is fixed a suction housing 220. The belt housing is pivotable about the drive 210 to set the kicker wheel at the correct height above the rod maker vee-rail. Attached to the belt housing is a bar 217 to which is fixed a guide plate 219. The guide plate is held above the vee-rail behind the kicker wheel and prevents the trailing ends of rods flicking up as the leading edge is picked up by the kicker wheel. It also acts to keep the rods in line. The suction housing is shown in figure 23 and comprises a solid flange having a central aperture 222 and a hub 224 which is connected to the belt housing. A suction passage 226 is formed in the periphery of the flange at a position between the central axis of the flange and the front face. The suction passageway passes through the flange to a suction reservoir 228 or the rear of the flange. The reservoir 228 is provided to ensure a constant suction as will be described. The reservoir 228 is connected to a suction pump (not shown).

At a position adjacent and slightly behind the suction aperture (in the direction of rod movement) is a second passageway 229. This passageway 229 is a rod release passageway and is connected to an air supply (not shown) at the rear of the flange, the rod release passage way 219 passing through the flange approximately parallel to the suction passageway. The air supply pushes air through the rod release passage way to break the suction applied by the suction passageway to release rods from the kicker.

Over the suction flange, which is static, is arranged a kicker wheel 230. The kicker wheel comprises a front face 232, a peripheral flange 234 and a hub 236.

The hub passes through the central aperture 222 of the suction flange and is fixed to the kicker shaft 214 for rotation therewith. The peripheral flange is not continuous but divided into two sections of equal length by a pair of flats 238. Each flange section has a groove 240 running along its length with a series of equally spaced holes 242 formed at the base of the groove. The grooves are arranged off the centre of the flange such that they overlie the suction and rod release passageways of the suction flange, and such that when mounted on the housing, the grooves overlie the centreline 250 (fig 13) of tobacco rods on the vee-rail of the rod maker.

In use, the kicker wheel 230 rotates above the rods on the vee-rail. The suction provided through the holes in the grooves picks individual rods from the rail and the rotation of the kicker wheel accelerates the rods towards the receiving drum. The reservoir in the suction flange ensures that the suction is maintained. As the suction is communicated through holes in the groove, the suction is effectively being switched on and off as the holes pass over the suction aperture. The reservoir mitigates against a loss of suction which might cause a rod to be released from the kicker. This is particularly important with double length rods whose increased weight requires a greater suction.

A rod will be released from the kicker when a flat on the kicker periphery passes over the suction passageway releasing the suction. However, there is a tendency for there to be some residual suction which can lift the tip of the rod. As can be seen from figures 10 and 11, the clearance between the flutes of the receiving drum and its cover is small and a raised tip could be damaged by the cover or, in the worst case, be prevented from entering the receiving drum causing the whole manufacturing line to break down.

The air blown through the rod release passageway ensures that any residual suction is broken and that the

tip of the rod is exactly parallel with the receiving drum flutes when it is released. This ensures that the rod is successfully transferred from the vee-rail to the receiving drum.

Referring to Figures 21 to 25, the rods from the kicker are passed to a receiving drum 334. Rods are introduced onto the receiving drum from a direction parallel to the axis of rotation of the drum. Alternatively, a helical kicker could be used which would transfer rods in the same direction. The receiving drum is a fluted drum having 18 tapered flutes 336 around its periphery, each of which receives an individual rod from the kicker 332. The outer sleeve of the receiving drum is shown in figure 24.

A conventional receiving drum has 36 flutes. The 18 flutes of the drum 334 have mouths which are wider than conventional flutes facilitating transfer from the kicker at high speeds. It will be appreciated that to operate at 8000 cpm, the receiving drum must rotate at 222.2 rpm giving a capacity of 4000 double length rods per minute.

Each of the flutes has a tapered receiving end 338 which assists in guiding the rod into position. It will be appreciated that the angle of the taper may be selected to provide the best transfer within the constraint of having 18 wide flute mouths 340 around the periphery of the drum. Thus, the flutes are formed of two portions, a rod braking and holding portion 341 which is narrow and sufficiently long to hold a double length rod and a tapered portion 343 which is shorter than the rod holding portion and tapers from the mouth 340, at which it is several times the width of the narrow portion, to the rod holding portion.

The rods arrive at the drum from the kicker at high speed. The flutes include a row of vacuum holes 347 through which air is sucked to brake the rods and to hold them in position in the drum. Preferably, the vacuum holes extend along the length of the rod holding portion

into the tapered portion of the flute along the centre longitudinal axis 349 of the flute. This gives the operator maximum control of the rod and allows the rod to be controlled as soon as it enters the flute. The drum sleeve illustrated in Figure 24 is shown with the rod stops removed. The rod stops are fixed in place by screws held in screw holes 351 and their position is variable. The row of suction holes extends as far as the stop, the final hole 353 being enlarged. At the far end of the row of holes 347, each of the rows terminates in an elongated slot 355. The holes in the flutes, with the exception of the end holes 353, are threaded so that they can be blocked off to tune the flutes. It may be necessary, for example to reduce the suction for a less dense cigarette rod.

The flutes are of equal length and width. To receive a double rod, the flutes may need to be longer than those of a standard receiving drum. The portion of the drum which transfers rods is protected by a suction cover assembly 345 which assists in retaining the incoming rods in the flutes by creating an air flow channel between the flute and the cover 342. Preferably, the cover 342 is transparent. Cover assemblies are well known in the art and the present assembly differs from the prior art in that it is longer to cover the longer flutes and in that it is provided with a series of holes 361. These holes 361 can be seen from figures 11 and 12.

The stops at the end of the rod holding portions are positioned such that rods are aligned with their centres on the centre line of the transfer apparatus.

At the front of the drum is an internal rib 359 extending around the inner surface and having holes for attachment to a front plate.

The outer sleeve of the receiving drum is mounted on the suction housing which is illustrated in figure 25. The suction housing has an air outlet 390 which is connected to a suction pump (not shown) and four ports

392 which communicate with the suction holes in the flutes of the outer sleeve enabling air to be drawn by the pump through the suction holes and extracted through the air outlet 390, thereby providing the necessary suction to retard and hold tobacco rods in the flutes. The suction ports 390 are arranged around the suction housing to ensure that adequate air can be drawn through the suction holes in the flutes along the entire length of the flutes. For that reason, the position of the ports 392 is staggered on the suction housing.

Rods from the receiving drum are transferred onto an intermediate drum 344. This drum also retains rods in 14 flutes by suction. The drum rotates at 285.7 rpm to achieve 4000 rods/minute operating speeds.

The flutes of the intermediate drum are sufficiently long to retain a double length rod. But, in contrast to the receiving drum, the entire rod length is not held in the flutes of the intermediate drum. Only a centre portion is held with the ends overhanging a cutaway at either end of the flutes. Thus, the flutes of the intermediate drum are considerably shorter than the rod holding portions of the receiving drum.

Rods are transferred between the receiving drum and the intermediate drum and then the other drums using picking techniques. This method is well known in the art and involves suction holding a rod in the flute of a first drum, releasing this suction at the transfer point enabling the rod to be transferred by suction onto a flute of the next drum where the suction in that flute retains the rod in position.

From the intermediate drum 344, the rods are transferred to a cutting drum 346 where the double length rods are cut at their medial point into two single lengths. The rods are then separated on a separating drum 348 and passed to a filter assembly drum 350. While on the filter drum, a double length filter rod is inserted from the tipper between the spaced apart rod

lengths. In the tipper, this filter is attached to the two rods and then cut to produce two finished cigarettes.

The cutting and separating drums are standard drums as used, for example on the Hauni Max-80 transfer apparatus. The filter drum may be a standard drum as used, for example on the Hauni Max-S transfer drum. No further description of these items is necessary.

It will be appreciated from the Figures that the receiving drum rotates in a clockwise direction. The intermediate drum picks out the rods from the receiving drum and is required to obtain the correct flow direction of the tobacco rod.

The five drums are mounted in a transfer housing 352 which, in use, is attached at its one end to the tipper, for example at mounting point 353. A support bracket assembly 354 is also provided to support the weight of the drums. The bracket additionally is attached to the tipper.

Referring now to Figure 23, there are shown only the major components of the transfer apparatus with many standard components omitted. The drums are driven from a single drive motor through top-hat shaped gear 356 attached to the drive shaft 358 of the receiving drum. A housing 360 is arranged over the drive shaft and a suction housing 362. The suction housing is retained in the receiving drum by a series of bearings and rings 362 and a bearing and seal retainer ring 364 to which the fluted portion of the receiving drum is attached. An end plate 365 is attached to the end of the drum.

It will be seen from Figure 23 that the gear 356 is a top-hat gear and that the inside mating surface around aperture 365 in the transfer housing which receives the drive shaft and the show housing has a spot face recess 366. The gearing and the spot face recess allow conventional components to be used with minimal modification. The housing 352 is sealed by a removable cover 368.

A back cutting plate 370, having apertures 372,374,376 is arranged on the front of the housing 352 so that upper aperture 372 and central aperture 374 overlie corresponding apertures 378,380 in the housing for the intermediate and cutting drums respectively. The back cutting plate is positioned between the housing and the intermediate and cutting drums. All of the drums include suction housings to enable the rods to be held in their flutes. Suction housing 382 for the intermediate drum is received in location aperture 378 in the transfer housing 352 and the intermediate drum is arranged on the suction drum. A location ring 386 is provided to enable a conventional Max 80 receiving drum mounting to be used with the intermediate drum. The location ring is necessary as the Max 80 receiving drum is intended to be used with a variable height Hauni Spider, as a result of which the drum mounting plate, here the back cutting plate 370, is designed to pivot about the cutting drum. That plate is now fixed ensuring constant centres.

Suction housing 383 for the separation drum locates in location aperture 384 in the housing.

The drive for the receiving drum and the suction for all the drums are conventional and are not described here.

The arrangement of the flutes in the various drums is such that the rods pass along the centre line of the transfer point. The use of chamfered or tapered flute leads of twice the normal width, and the accompanying reduction in the number of flutes, together with the increased length of receiving drum and the use of vacuum holes along the entire length of the flutes results in a transfer apparatus that can reliably transfer double length rods using a kicker rather than a spider.

The tipper is shown schematically in figure 26. This diagram also shows elements of the transfer apparatus which have the same reference numerals and will not be described again. The tipper 400 includes a hopper

402 which holds a reservoir of filters for supply to the filter drum. The filter hopper may be fed manually from trays or automatically from automatic trays or from a plug shooter. The filter rods in the hopper may be of four or the six up configuration, that is four filter tips per rod or six filter tips per rod which means they will be cut into two or three double length rods to be inserted between the separated single length rods on the separating drum. Thus each six up filter rod will eventually provide the filters for six cigarettes. The filter rods are deposited into the grooves of a filter cutting drum 404 from the hopper where they are cut by knives into two or three double length filters which are inserted between the cigarette rods on the filter drum.

The tobacco rods are joined to the filters by tipping paper which is supplied from a bobbin 408 which is loaded manually on to the tipper. The tipping paper is drawn from the bobbin by a tension roller 410. The bobbin has a free end which is fed into a splicer unit. Splicing of the full bobbin onto the end of an expended bobbin is carried out automatically. As a consequence the machine does not have to stop to replenish bobbins. Loading of the bobbins is manual.

The tipper also includes a gluing unit 412 which supplies glue from a reservoir to the tipping paper which is then cut into single length strips by an arrangement of 11 or 8 knives. Individual glued strips are then fed on to the rod-filter-rod combinations on the swash plate drum. A heated rolling block is then used to wrap the tipping paper around the rod/filter tip combinations and to set the adhesive to make a double length cigarette. The double cigarette is then cut though the centre line of the filter to form two single length cigarettes which are opposed. The cutting drum includes a rejection port though which can be rejected rod pairs in between which no filter has been inserted. Also rejected are tipped cigarettes which include the cigarette wrapping paper

splice or the filter tipping paper splice. The finished cigarettes on one side of the machine are passed to a turning drum which reverses the cigarettes so that all the cigarettes are facing the same direction. This facilitates further processing.

After the tipping unit, the finished cigarettes are passed to an inspection unit which comprises an inspection drum where the cigarettes are subjected to a leakage test to check for holes or imperfections in the paper. This test is carried out by blowing compressed air through the cigarette and measuring the pressure drop across the cigarette. The compactness of the cigarette and the presence of a filter is checked, for example, by an optical or capacitance sensors. Any rod that fails either of these tests is rejected and ejected off the inspection drum. As an optional additional test dilution tests may be made to test the effectiveness of the attached filter to allow air to be drawn through its side perforations. After the inspection drum, cigarettes that have not been rejected are passed downstream to a tray filler or other processing unit which does not form a part of the present invention.

Conventional rod makers and tippers are driven from a single drive from which are taken a variety of secondary drives through appropriate reduction gearing. This is very bulky and inflexible. The combined rod maker and tipper embodying the present invention dispenses with that arrangement and uses a number of separate drives which are interconnected and controlled by a dedicated motion controller. The rod maker and tipper are controlled by the same PLC controller.

Figures 27, 28 and 29 show, respectively, the location of the principal motors in the rod maker and the tipper respectively. Tables 1 and 2 below show, respectively, the listing and function of each motor in the rod maker and the tipper.

Motor	Function
M2	Large Fan Motor
M3	Small Fan Motor
M4	Oil Pump Motor
M6	Hopper Motor
M8	Tobacco Return (vibrating tray) motor
M9	Cut-off cooling fan
M10	Cut-off cooling fan
M10.1	Cut-off cooling fan
M11	Control cabinet cooling fan
M12	Hopper Tangential Feeder motor
M14	Hopper Tobacco Delivery Roller motor
M15	Bobbin changer Capstan motor
M17	Weight control motor
M19	Tipper dust extractor
M21	Cut off motor(master for motion control) - drives cut-off knife drum
M22	Ecreteur motor (position synchronised) - drives dense end cam and ecreteur discs
M23	Printer motor (position synchronised) -drives print die wheel
M24	Tape drum motor (velocity synchronised) - drives garniture tape drum
M25	Suction chamber motor(velocity synchronised) - drives suction tape
M26	Hopper motor (velocity synchronised) - drives hopper carded drums

Table 1: Rod Maker Motors

Electrical Reference	Motor Description	Motor Function
Tipper main drive motor (TMDM)	Position Synchronised to Cut off motor	Drives complete tipper gear train
M3	Bobbin Swivel	Swivels the bobbin plate
M4	Glue Stirrer	Provides drive for glue rollers
M5	Glue Pump	Glue feed
M7*1	Fan	Provides Suction for tipping drum
M9*1	Vacuum Pump	Drives knife 1 (filter)
M9*2	Knife 2	Drives knife 2 (tobacco rod)

Table 2: Tipper motors

It should be appreciated that although the system has been described in terms of servo motors, non-servo motors could be used as some degree of control can still be achieved using a conventional variable speed motor with a speed control signal. Alternatively, motors using embedded intelligence may be used to provide synchronisation.

Referring now to figure 29 the positioning of the motors referred to in Table 2 can be appreciated. The main drive motor can be a synchronous servo motor. The other motors on the tipper are standard fixed speed motors. Figures 27 and 28 show the equivalent situation for the rod maker although some of the motors are omitted for clarity.

A preferred embodiment of the control system comprises the following main elements:

1. The machine controller;
2. The motion controller and servo motors;
3. The fieldbus connecting sensors, pneumatic valves and some motor drives to the machine controller;

4. The HMI; and
5. Inspection and rejection.

The machine controller comprises two PCS running the Windows NT (TM) operating system and configured such that one is a server and the other a client. Other operating systems such as WIN CE may be used. The PCs communicate via TCP/IP and Ethernet. The controller software controls both the maker and the tipper using standard PLC functions but without a PLC. The PCs communicate with the machine devices via the fieldbus.

The motion controller and servo motors provide synchronised control of servo motors on multiple axes by an advanced motion controller. Each axis is programmable for motor characteristics, speed, position and phase relationships. Synchronisation between motors relies on high speed communications between each axis controller which is independent of the fieldbus.

The fieldbus connects devices and I/o terminals to the machine controller via a single cable. Sensors attach either directly to the fieldbus cable or to connector blocks on the cable. Pneumatic valves may be attached to the fieldbus via their own interface in their valve island block and other motor drives and the motion controllers connect directly to the cable.

The HMI provides an easy to use, graphical interface for the operation, maintenance and configuration of the machine. In a preferred embodiment it uses a touch screen for operator command entry. The HMI provides on screen buttons, sliders, keyboards etc. for input of data and commands to the machine, as well as on-screen messages, gauges, digital displays, graphs, reports etc. to provide information to the operator. It also includes a database for multi-language messages and for historical records.

Inspection and rejection systems are controlled by an independent, dedicated programmable controller which interfaces to the machine controller and HMI for parameter settings and performance display.

The motion control, fieldbus and HMIs aspects of the control system will now be described in greater detail.

Motion Control. It will be appreciated that the synchronised servomotors are all synchronised to the cut off motor M21 which is the master for motion control. Alternatively, synchronisation may be to a virtual axis. The relationship between garniture belt speed and the cut-off motor speed determines the length of the cut tobacco rod. The ecreteur and printer motors are speed and position synchronised with the cut-off motor and the tipper main drive motor is position synchronised with the cut-off motor. The Tape drum motor, the suction chamber motor and the hopper motor are speed synchronised with the cut-off motor.

In conventional making machines, these motors have been fixed by complex arrangements of gear boxes, shafts, drive belts etc. to support the various main functions controlling the product. By using a motion control system, the one main drive motor and associated drive system may be eliminated. Instead, a number of drives axes are used as the optimum solution between a totally mechanical and totally electrical system. It will be appreciated from tables 1 and 2 that the preferred embodiment has 7 axes, 6 in the maker and 1 in the tipper. Of course, other numbers are possible and other motors may be introduced on separate axes. Use of motion control has the obvious advantage of eliminating some costly gearboxes, but also reduces maintenance, reduces build time and reduces noise. This is especially important in the context of increasing production speeds. Furthermore, motion control allows the phase relationship between the various axes to be used as an alternative to mechanical settings to give much more accurate results in much less time. It allows almost infinite tuning of the relationship between the axes. For example, the mechanical relationship of the tipper catching drum to the cigarette maker is greatly simplified. Moreover, the relationships between the various axes can be varied dynamically. Thus in the example given above, the phase relationship of the catcher drum could be varied according to the machine speed to ensure optimum transfer. A further advantage is

the ability to change rod length without changing parts. Usually a change in rod length would signify a change to production of a different brand. This requires a different label to be printed onto each rod. The print label could be changed electronically using ink jet printing techniques and the relative position on the rod as well as the rod length can both be adjust by varying the relationships between the axes under motion control.

The motion control comprises the seven motors identified earlier each with a motor controller mounted on a backplate with a dedicated processor. The control could alternatively be embedded in the motor. The processor is programmed to synchronise and phase control the motors via their individual controllers and information on phase and speed is fed to the motion processor via a dedicated high speed transmission line. As will be explained, the motion controller may also be connected to the field bus so that it can receive control signal such as stop, start, jog etc. and parameter signals such as speed, phase, etc. and can send status signals to the system. The other motors which do not form a part of the motion control system are connected to the fieldbus either via their controllers or via their direct on-line starters.

Fieldbus. The fieldbus consists of a cable routed around the maker and the tipper to form the backbone of the control system. The controllers and the controlled elements connect to this cable. The flow of signals is controlled by a software protocol. The presently preferred protocols are DeviceNet (TM) and Profibus (TM). This protocol controls signal flow between elements connected to the fieldbus to enable specific signal to be routed to and from specific devices. In the DeviceNet protocol, each signal is a packet containing 8 bytes of data. The packet is preceded by a header which contains information about the content of the message and its priority. Other devices on the fieldbus will be programmed to certain message contents and so will accept or not the message depending on the content of the header. The priority content ensures that only one device transmits at a time. In this way the control system may be configured such that a central controller, typically a PLC or a

PC may control all functions or may be configured such that no central controller exists and intelligent devices communicate with other intelligent devices using peer to peer communications; these devices then perform the control functions related to their own applications.

The devices connected to the fieldbus may be similar to conventional devices with the addition of a processor whose function is to code information for transmission and to decode message the device needs to receive. Thus, for example, a switch would need to transmit information as to whether it is operated or not and possibly diagnostic information such as whether its operating surface is dirty, whether it is overheating, is receiving too much vibration etc. On the other hand, a motor could transmit information such as speed, torque, direction of rotation, power temperature etc. The motor may also receive information such as start, stop, jog, change speed or direction etc. Devices that do not have the necessary processor embedded may still be connected to the fieldbus but will require an interface which will handle coding and decoding. Of course in that case, the device cannot produce diagnostic information.

Figure 30 shows an overview of a first embodiment of the control system. A field bus 500 connects six main system blocks: the maker 502, the maker cabinet 504, the tipper 506, the tipper cabinet 508, the inspection unit 510 and the control system 512. The maker block includes the maker HMI 514, a number of blocks of sensors, here shown as sensor blocks 516, 518 and 520, and a block of pneumatic valves 522. Each of the sensor blocks, the valve blocks and the HMI are connected to the fieldbus 500. The maker cabinet 504 has a number of variable speed drives and a maker machine controller each attached to the fieldbus. In the figure, variable speed drives 524-530 are shown for the picker/winnower, large and small fans and tobacco return. In the tipper, the tipper HMI 532 is connected directly to the fieldbus as are drives block sensors 534, glue area sensors 536, pneumatic valve clutches 538 and pneumatic auto cleaning valves 540. In the tipper cabinet, the tipper machine controller 542 is connected to the fieldbus 500. In the inspection unit, a

DeviceNet scanner 544 is connected to the fieldbus. Connected to the Scanner 544, which acts as an interface, is an inspection and rejection controller 546.

A DeviceNet manager 548 is also connected to the fieldbus. Of course, this manager is chosen according to the fieldbus protocol being used. Finally a central controller 550 is also connected to the fieldbus. This central controller 550 has overall control over all machine functions over the fieldbus. The central controller 550 has VGA, keyboard and mouse inputs 551, which are also attached to a further PC 552 for programming input and to a data capture device 554 which is connected to thee DeviceNet manager 548 via a local Ethernet 556.

The synchronous motor motion controller 557 is connected to the central controller 550 via a remote I/O link 558. It will be appreciated that the motion controller is not connected to the fieldbus. Thus, for example, operating parameters input via the HMIs, which themselves may be accessed remotely are received first by the central controller which can send them to the motion controller if appropriate. Control of speed and phase of the synchronised motors is therefore separate from the HMI functions.

Figure 31 illustrates an alternative control arrangement. In this figure the two HMIs, shown as operator control touch screens 560, 562 are connected by a graphics cable link to the central machine controller 564 and are kept remote from the fieldbus or control network 566. Although one of the HMIs 560 is shown dissociated from the maker cabinet, there is still one HMI for the maker and one for the tipper. The machine controller is connected to management supervisory systems 568 and to the factory network 570 via an Ethernet link. In the maker and tipper cabinets, the valves and various I/O devices are all connected to the control network before. However, in addition, the motion controller 572 is also connected to the control network. It will be appreciated that the HMIs are still separated from the motion control by the overall machine controller 564. In figure 31, a representative selection of maker functions are shown connected to the control network. This is not exhaustive.

HMI. Two HMIs are required providing different functions, one for the tipper and one for the rod maker. This gives rise to the need for two PCS. The PCS are configured such that the database and one HMI process reside on the server PC and the other is configured as a client.

The HMI software, in addition to displaying machine control and message functions allows the integration of other PC applications for historical data analysis, performance reports to networked PCS or systems and on line diagnostic and help facilities such as parts catalogues, operator manuals, expert systems and operator training videos.

The HMI uses open technologies to allow maximum connectivity and use of technologies such as the Internet and Object based programming. This may be utilised to connect to other applications within the factory for maintenance tracking and to a central parts supplier for predictive maintenance and parts ordering. Other applications are, of course possible and will occur to those skilled in the art.

A separate HMI is provided on both the tipper and the rod maker although a single HMI could be used. The HMIs are each controlled by a PC which may be connected through a TCP/IP link for example to a remote LAN. This gives rise to the possibility of accessing the controllers of the tipper and the rod maker from a remote location possibly not even in the factory. The HMIs provide the system supervisor with a software interface to the cigarette making machine. The HMI displays comprise a configurable selection of function buttons, which may be displayed on, for example, a touch sensitive display screen. An operator can input a password from a keypad which will give access to one of a hierarchical set of control levels. For example a master password gives complete access to the system whereas a more restricted access may only allow the user access to certain control functions. As an alternative to a keypad, passwords or user identifiers may be stored on swipe cards or other identification devices and the HMI provided with a suitable card reader.

The HMI may be implemented as a PC with a suitable interface to the machine controller.

Figures 32 to 36 show examples of HMI screens which are presented to the operator. Many of the user selectable features are represented as push buttons. These are areas of the scree which perform a function equivalent to a push button when selected by the operator. As can be seen from the shading of the buttons shown in the figures, different types of function may be displayed as different coloured buttons. For example, each of the following functions may be represented by a different colour: change to another screen; stop a function that is presently running; start a non-running function; inching (very slow movement of a component such as a motor; fault reset; and miscellaneous. At any given time, the HMI will only display to the operator a fraction of the available information, or the available controls. Figure 37 shows the relationship between various different screens which could be presented to an operator with the appropriate level of clearance. It will be clear to those skilled in the art that figure 37 only shows a few of the screens which could be displayed.

The screen shown in figure 32 is the main menu. The information is presented on four rows. The first row 420 is for message display. In figure 32 this informs the operator that the machine is stopped having detected a fault in the roll block heater which is outside its preset operating range. The message row would also display the machine speed in cigarettes per minute if the machine was running.

The second row has only a FAULT RESET button 422' by which the operator resets the machine after a fault has been cleared. The third row has a STOP button 424, selection of which causes the machine to come to a controlled stop; and a SUCTION CHAMBER GUARD 426.

The fourth row has, from left to right, the following buttons:

PREPARE MAKER 428

PARAMETER ADJUST SCREEN 430

PHASE SHIFT SCREEN 432

MAINTENANCE MODE SCREEN 434
ADVANCED DIAGNOSTICS SCREEN 436
GO TO CONFIG SCREEN 438

The PREPARE MAKER button 428 selects the prepare maker screen shown in figure 33. The PARAMETER ADJUST SCREEN button 430 selects the parameter adjust screen shown in figure 34. Selecting the PHASE SHIFT SCREEN button 434 takes the operator to a phase shift screen shown in figure 35. Selecting the MAINTENANCE MODE SCREEN button 434 takes the operator to a maintenance mode screen and selection of the ADVANCED DIAGNOSTICS SCREEN and GO TO CONFIG SCREEN buttons 436, 438 takes the operator to advanced diagnostics and go to configuration screens respectively.

Turning to figure 33, the first row of the prepare maker screen is similar to that of the main menu but additionally includes a display of the present heater temperature. On the second row, in addition to the FAULT RESET button are MAKER FANS, TOBACCO FEED, HOPPER and GARNITURE TAPE buttons 440, 442, 444 and 446. Each of these four buttons turns the respective item on or off when selected. The third row of the screen has, in addition to the suction chamber guard button displayed on the main screen, ROD HEATER ON, HEATER DOWN, MANUAL GLUE and SUCTION CHAMBER TENSION buttons, 448,450,452 and 454. The ROD HEATER on button switches on the rod heater and the HEATER DOWN button brings the heater down allowing lap and heater settings to be checked. The MANUAL GLUE button switches the glue supply on and off and the SUCTION CHAMBER TENSION button allows the suction tape tensioner to be switched on and off. When off, the tape can be removed and changed. The SUCTION CHAMBER GUARD button turns the suction chamber guard on and off.

The fourth row of the prepare maker screen has a MAIN MENU button 456 which returns to the main menu, and buttons 458, 460 RUN MAKER IN MANUAL and RUN MAKER IN AUTO which take the operator to manual/automatic running screens (not shown). The RUN MAKER IN MANUAL button will only operate if the software detects that the MAKER FANS button 440 is on, and the RUN MAKER IN AUTO

function will only operate if the MAKER FANS, TOBACCO FEED and HOPPER buttons are in an on position.

The PARAMETER ADJUST screen in shown in figure 34. This allows the operator to adjust certain parameters of the rod maker from the HMI simply by pressing the relevant areas on the screen. The information on the PARAMETER ADJUST screen is divided into five rows. On the first row are buttons INCH SPEED, MAKER HEATER and CIGARETTE LENGTH 462, 464, and 466, for adjusting the inch speed, the temperature of the maker heater and the cigarette length respectively. On the second row are buttons LOW SPEED, HEATER MAKER STOP HIGH LIMIT and MAKER HOPPER SPEED 468, 470 and 472 for setting low running speed (in cigarettes per minute), for automatically stopping the maker heater when the temperature reaches the set level, and for setting the hopper speed. On the third row are buttons 474, 476 PRODUCTION SPEED and MAKER HEATER STOP LOWER LIMIT for setting production speed and the lower limit of the maker heater. The sole button 478 on the fourth row MAINTENANCE SPEED sets the machine speed for running during maintenance operations. On the fifth row, the sole button 480 PREVIOUS SCREEN returns the user to the previous screen.

Figure 35 shows the phase shift screen. This display has four rows of buttons, the first two of which perform self explanatory functions. On the first row are PRINTER ADVANCE, ECRETEUR ADVANCE and TIPPER ADVANCE buttons 482, 484 and 486. On the second row are PRINTER RETARD, ECRETEUR RETARD AND TIPPER RETARD buttons 488, 490 and 492. On the third row is a PHASE ADJUST button 494 which allows the operator to select the amount by which the selected axis from one of the first two rows is adjusted. Typically the adjustments will be in increments of 0.1mm. The fourth row has PREVIOUS SCREEN and STOP buttons 496 and 498.

The screens illustrated are all examples of maker HMI screens. It will be understood that the tipper HMI displays similar screens as appropriate to the tipper functions. The PREPARE TIPPER screen is shown at figure 36.

Figure 38 is a flow chart which explains the major control steps of the controller. The controller, which is separate from

the HMI may typically be a PC using control software applications running under Microsoft Windows NT, or a display panel.

On initialisation, once the controller has established that the machine is ready to start (at 700), the controller performs a start up routine at 702 and then actively monitors the cigarette production speed at 704. The production speed may be input through the HMI with other production data such as tobacco rod length, tobacco density and print position. In practice, most of these variable are fixed for a given brand of cigarettes and the operator can simply enter through the HMI the brand of cigarette to be manufactured. The combined tipper and rod maker described can operate at speeds of up to 8000 cigarettes per minute (cpm).

At any time during production, the operator can stop the machine. At step 706, the controller looks for an indication of a manual stop and if one is detected stops production and causes that information to be sent to the HMI for display. The controller then keeps looking for a reset command which, when received causes the controller to return to the beginning of the control process. At Step 708 the controller monitors the data on the fieldbus for an emergency stop signal which may be received from one of the devices on the fieldbus, for example in the event of an actual, or impending catastrophic failure of a component. At step 710 the controller monitors the data on the fieldbus for an indication of a fault condition. In either steps 712 or 714 the controller will cause production to be halted and look for a reset command in the same manner as with a manual stop.

The smart devices plugged into the fieldbus may be capable of distinguishing between a condition which requires the production line to be halted and a fault which requires fixing when convenient. At step 716, the controller looks for warning signals put on the fieldbus by any of the devices and relays this warning to the HMI, for example to be displayed, printed or otherwise drawn to the operator's attention. At step 718, having failed to find any reason that requires the production to be stopped, and after any warning messages have been sent to the HMI, the controller at steps 720 and 722 looks for information from sensors located at the wrapper paper bobbin and the tipping

paper bobbin to determine whether either of the bobbins need to be changed. If one does, the controller checks to see that a fresh bobbin is present and then, at step 724 or 726, runs the appropriate splice routine which will involve controlling the speed of the bobbin to gradually bring it up to the manufacturing speed while monitoring the condition of the paper reservoir.

At step 728, the controller looks to see whether there is data on the bus from the HMI and, if so, acts on it and communicates that fact to the HMI. At step 730 the controller sends data on the fieldbus to the HMI that does not fall into the categories described above and which might be required, for example operating data such as running speeds, output rates, reservoir levels, temperatures etc.

Figures 39, 40 and 41 are flow charts of the start up process and help to understand how the HMIs and the control PCS interact. When the operator begins the start up routine at step 900, the software first checks at step 902 that all emergency stops on the system are unlocked. Then at step 904, it checks that all guards and covers on the tipper and the maker are closed. At step 906 it checks that the compressed air supply is on and at step 908 and 910 it checks that the appropriate maintenance and cleaning schedules have been followed. Finally at step 912 the main isolators are checked and if on, the software enters the tipper start procedure at which point the operator selects the prepare tipper screen of figure 31. The tipper start procedure commences by checking, at 914 and 916, that the glue supply and tipper paper are in order. If they are, the operator selects from the HMI screen, at steps 918, 920, 922, 924, 926 and 928, the ROLL BLOCK, TIPPER FANS, GLUE ROLLER, KNIVES MOTOR, AUTO/MANUAL and INCH to turn each function on and select between automatic and manual operation. The INCH function will advance the tipper until it is determined, at 930, 932, that the tipper paper feed is in the correct position and the filter plugs are on the feed drum. At that point the software can proceed to the maker start routine illustrated in figure 35. The operator initially selects the display language at the HMI, at 934 and then presses, at 936, the prepare maker screen from the

main display. On the prepare maker screen, the operator then switches on the maker fans, the tobacco feed, and the hopper at steps 938,940 and 944. At 946, the operator loads the bobbin with paper and threads the paper through the printer and then, at 948, selects INCH from the HMI display whereupon the drives are slowly moved round until the software detects that tobacco is available at 950 at which point paper is fed along the garniture and the print lever engaged at 952. When it is found that all materials are feeding correctly, at 954, the operator can select at 956 the RUN MAKER IN AUTO button from the prepare maker screen and the run automatically from the AUTO RUN screen.

The cigarette rod maker and tipper described, and the method of control have a number of advantages over prior art systems. The use of synchronous drive motors eliminates the need for noisy inefficient gearboxes running off a central motor facilitating an increased running speed. Moreover parameters such as print position, and dense end position can be moved as a control operation related to the printer or cam phase. This means that these parameters can be adjusted with reduced production stoppage time. This results in an improvement in quality which can reduce production costs. As well as giving higher operating speeds, the use of synchronous servo motors is much less noisy which contributes to a more benign working environment. In addition the energy requirements are much lower. A further advantage of the system is that by dispensing with a greater part of the mechanical linkages, the mean time between failures is increased. The use of a PC based HMI and smart sensors and other devices also reduces the mean time to repair as diagnostics information is available at the HMI. The HMI can also identify the particular component which requires replacing by use of an on-line catalogue. This in turn can reduce the size of inventory that has to be carried. As the HMI can be connected by a TCP/IP link to an Intranet or LAN, remote diagnostics are possible as well as remote repairs and upgrades. In addition, factory data can be downloaded from a central source to one or a number of machines. This, may include information such as master clock, shift times, brand data etc. Furthermore, the HMI can be

programmed to carry instructional information which can used to inform operators, for example, about aspects of the machine control which they would rarely encounter, or to run interactive training programs, for example on CD-ROM or training videos for new operators.

Claims

1. A cigarette manufacturing apparatus comprising:

a tobacco rod maker for making double length tobacco rods;

a tipper for applying filters to tobacco rods to form filter tipped cigarettes;

a transfer apparatus for transferring double length tobacco rods from the rod maker to the tipper;

wherein each of the tipper and the rod maker comprises a plurality of devices for monitoring and/or affecting parameters of the rod maker, the tipper or the cigarettes being manufactured;

a controller for controlling the plurality of devices on the tipper and the rod maker; and

a field bus, the plurality of devices and the controller each being connected to the field bus.

2. Apparatus according to claim 1, further comprising a plurality of synchronous motors controlled by a motion controller.

3. Apparatus according to claim 2, wherein the motion controller is connected to the controller.

4. Apparatus according to claim 2 or 3, wherein the motion controller is connected to the fieldbus.

5. Apparatus according to claim 2, 3 or 4, wherein the plurality of motors includes a cut-off motor for driving a device for cutting individual tobacco rods, a suction chamber motor for driving a suction belt, and a garniture belt drive motor, and a hopper motor for controlling the rate at which tobacco is drawn from a hopper.

6. Apparatus according to claim 5, wherein the rotational speed of the suction chamber motor, the garniture belt drive

motor and the hopper motor are synchronised to the rotational speed of the cut-off motor.

7. Apparatus according to claim 5, wherein the rotational speed of the cut-off motor, the suction chamber motor, the garniture belt drive motor and the hopper motor are synchronised to a virtual axis.

8. Apparatus according to claim 5, 6 or 7 , wherein the plurality of motors further includes an ecreteur motor for driving a dense end cam and a pair of ecreteur discs, a capstan motor, and a printer motor for driving a printer to print onto the cigarette wrapping paper.

9 Apparatus according to claim 8, wherein the ecreteur motor and the printer motor are speed and position synchronised to the cut-off motor or the virtual axis.

10. Apparatus according to claim 5,6 or 7, wherein the plurality of motors further includes a tipper motor for driving a tipper drum train, wherein the tipper motor is synchronised to the position of the cut-off motor or to the virtual axis.

11. Apparatus according to any preceding claim further comprising at least one human-machine interface (HMI) connected to the field bus.

12. Apparatus according to claim 11, wherein the at least one HMI comprises a rod maker HMI and a tipper HMI, each of the rod maker HMI and the tipper HMI being connected to the controller via the fieldbus.

13. Apparatus according to any of claims 1 to 10, comprising at least one human-machine interface (HMI) connected to the controller.

14. Apparatus according to claim 13, wherein the at least one HMI comprises a rod maker HMI and a tipper HMI, each of the rod maker HMI and the tipper HMI being connected to the controller

15. Apparatus according to any of claims 11 to 14, wherein the at least one HMI is connected to a communications network.

16. Apparatus according to any preceding claim, wherein at least one of the plurality of devices is connected to the field bus via an interface.

17. Apparatus according to any of claims 1 to 15, wherein at least one of the devices is a field device.

18. Apparatus according to any of claims 1 to 15, wherein at least one of the plurality of devices transmits data including diagnostic data to the controller over the fieldbus.

19. A cigarette manufacturing apparatus comprising:

a tobacco rod maker for making double length tobacco rods;

a tipper for applying filters to tobacco rods to form filter tipped cigarettes;

a transfer apparatus for transferring double length tobacco rods from the rod maker to the tipper;

wherein each of the tipper and the rod maker comprises a plurality of devices for monitoring and/or affecting parameters of the rod maker, the tipper or the cigarettes being manufactured;

a first controller for controlling the plurality of devices on the tipper and the rod maker; and

a second controller for providing tipper, rod maker and cigarette information to an operator and for communicating input data from the user to one or both of the first and second controllers.

20. Apparatus according to claim 19, wherein the second controller includes at least one Human/Machine Interface (HMI) and communicates with the first controller, for communicating tipper, rod maker and cigarette data to an operator and for communicating input data to the first controller.

21. Apparatus according to claim 19, wherein the second controller comprises a tipper controller communicating with a tipper HMI and a rod maker controller communicating with a rod maker HMI.

22. Apparatus according to claim 21, wherein the tipper controller and the rod maker controller each comprises a PC or similar device.

23. Apparatus according to claim 21 or 22, wherein the tipper controller and the rod maker controller each comprise an HMI.

24. Apparatus according to claim 21, 22 or 23, wherein the tipper controller and the rod maker controller are interconnected.

25. Apparatus according to any of claims 19 to 24, wherein the first controller and at least some of the rod maker and tipper devices are connected to a fieldbus.

26. Apparatus according to claim 25, wherein the second controller is connected to the fieldbus.

27. Apparatus according to any of claims 19 to 26, wherein the second controller is connected to an external communications network.

28. Apparatus according to any of claims 19 to 27, further comprising a motion controller controlled by the first controller for synchronising a plurality of motors on one or both of the rod maker and the tipper.

29. Apparatus according to claim 28, wherein the plurality of motors includes a cut-off motor for driving a device for cutting individual tobacco rods and the remainder of the plurality of motors is synchronised to the cut-off motor.

30. Apparatus according to claim 28, wherein the plurality of motors is synchronised to a virtual axis.

31. Apparatus according to claim 26,27 or 28, wherein the motion controller is connected to the fieldbus.

32. Apparatus according to any of claims 11 to 15 or 20 to 24, wherein the HMI is configured to display to the operator one of a hierarchical set of display screens.

33. Apparatus according to claim 32, wherein at least one of the set of screens includes rows areas representing buttons for controlling rod maker or tipper functions.

34. Apparatus according to claim 32 or 33, wherein the HMI is configured to display diagnostic information from tipper or rod maker components.

35. A method of controlling the manufacture of cigarettes by an apparatus comprising a tobacco rod maker and tipper interconnected by a rod transfer apparatus, the method comprising the steps of:

providing a field bus and a machine controller connected to the field bus;

connecting a plurality of devices to the field bus, for monitoring and/or affecting parameters of the rod maker, the tipper or the cigarettes being manufactured;

monitoring the field bus from the controller for data from the devices;

and adjusting one or more parameters of the tipper or rod maker in accordance with the information content of the data received.

36 A method according to claim 35, further comprising providing a second controller to interface with the machine controller, wherein the machine controller receives data from and sends data to the second controller.

37. A method according to claim 35 or 36, wherein the machine controller looks for a signal on the field bus indicating a machine stop command input from the second controller and, if the machine stop signal is present, sends a stop signal to the field devices.

38. A method according to claim 35, 36 or 37, wherein the machine controller looks for a signal on the field bus indicating an emergency stop condition or indicating that a protective guard on the rod maker or tipper is not in place and, if the signal is present, sends a stop signal to the field device.

39. A method according to any of claims 35 to 38, wherein the machine controller looks for a signal on the field bus indicating a fault condition at one of the field devices and, if the fault condition signal is present, sends a stop signal to the field device.

40. A method according to any of claims 35 to 37, wherein the machine controller also communicates the stop signal to the second controller together with information identifying the cause of the stop signal.

41. A method according to claim 40, wherein the information sent to the second controller includes diagnostic information and component identification information.

42. A method according to any of claims 35 to 41, wherein the machine controller looks for a signal on the field bus warning of a non-ideal condition at one of the field devices and, if the warning signal is present, sends a warning signal to the second controller.

43. A method according to any of claims 35 to 42, wherein the field devices include a cut-off motor which controls the cutting of cigarette rods from a continuous length of wrapped tobacco produced by the rod maker and a plurality of further motors synchronised to the cut-off motor.

44. A method according to any of claims 35 to 42, wherein the field devices include a cut-off motor which controls the cutting of cigarette rods from a continuous length of wrapped tobacco produced by the rod maker and a plurality of further motors, the further motors and the cut-off motor being synchronised to a virtual axis.

45. A method according to claim 43 or 44, wherein the synchronised motors include motors synchronised by speed and motors synchronised by position.

46. A method according to any of claims 35 to 45, wherein the machine controller looks for a signal on the field bus indicating that a wrapping paper bobbin or a tipping paper bobbin is nearly exhausted and, if the signal is detected, initiates a routine to splice a fresh paper bobbin onto the present paper bobbin.

47. A cigarette manufacturing apparatus comprising:

a tobacco rod maker for making double length tobacco rods;

a tipper for applying filters to tobacco rods to form filter tipped cigarettes;

a transfer apparatus for transferring double length tobacco rods from the rod maker to the tipper;

a plurality of synchronised motors each for driving a respective operation in the tipper or the rod maker;

wherein each of the tipper and the rod maker further includes a plurality of devices for monitoring and/or affecting parameters of the rod maker, the tipper or the cigarettes being manufactured;

a motion control device for controlling the plurality of synchronised motors;

a system controller for controlling the plurality of devices on the tipper and the rod maker, the motion control device being connected to the system controller; and

a field bus, the plurality of devices and the controller each being connected to the communications network.

48. A cigarette manufacturing apparatus comprising:

a tobacco rod maker for making double length tobacco rods;

a tipper for applying filters to tobacco rods to form filter tipped cigarettes;

a transfer apparatus for transferring double length tobacco rods from the rod maker to the tipper;

wherein each of the tipper and the rod maker comprises a plurality of devices for monitoring and/or affecting parameters of the rod maker, the tipper or the cigarettes being manufactured;

a control network, the plurality of devices being coupled to the control network;

a first controller connected to the control network for controlling the plurality of devices on the tipper and the rod maker; and

a second controller coupled to the first controller and including at least one HMI for providing tipper, rod maker and cigarette information to an operator and for communicating input data from the user to the first controller.

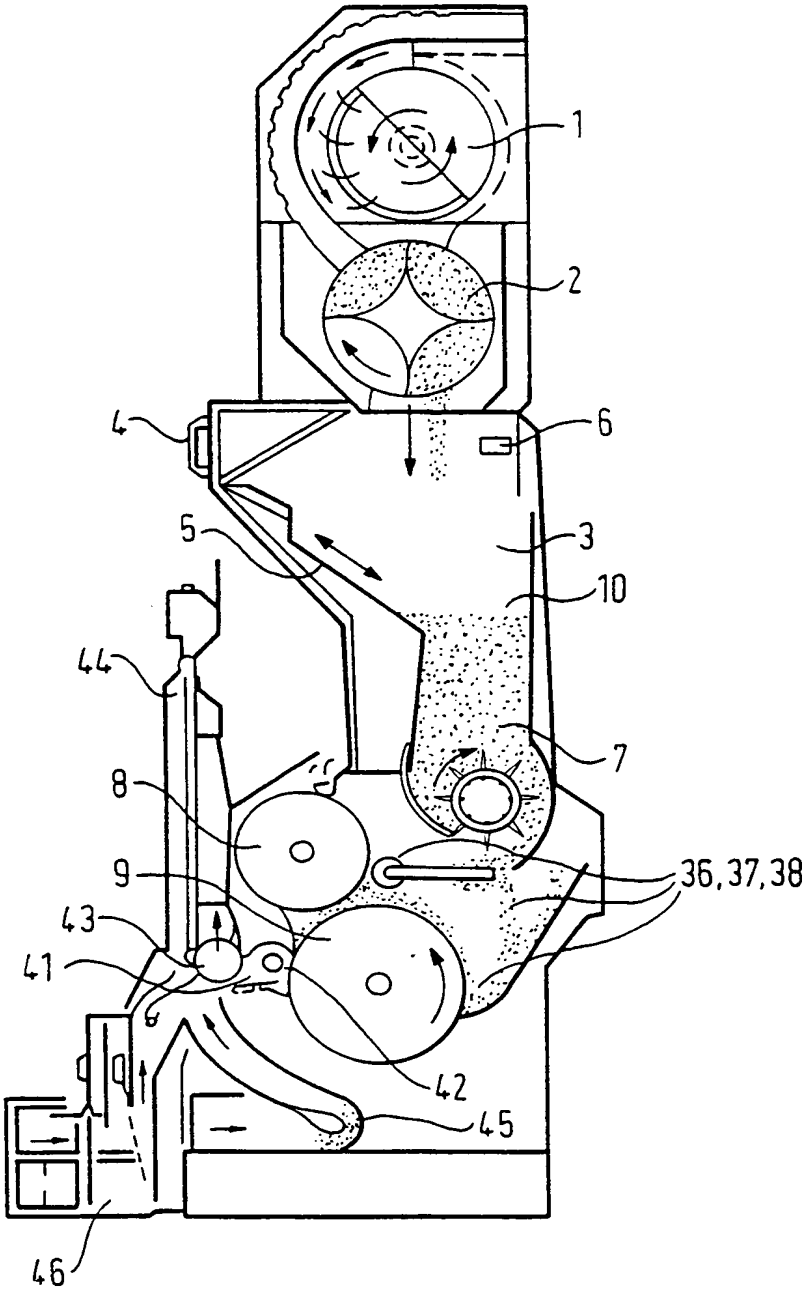


FIG. 1

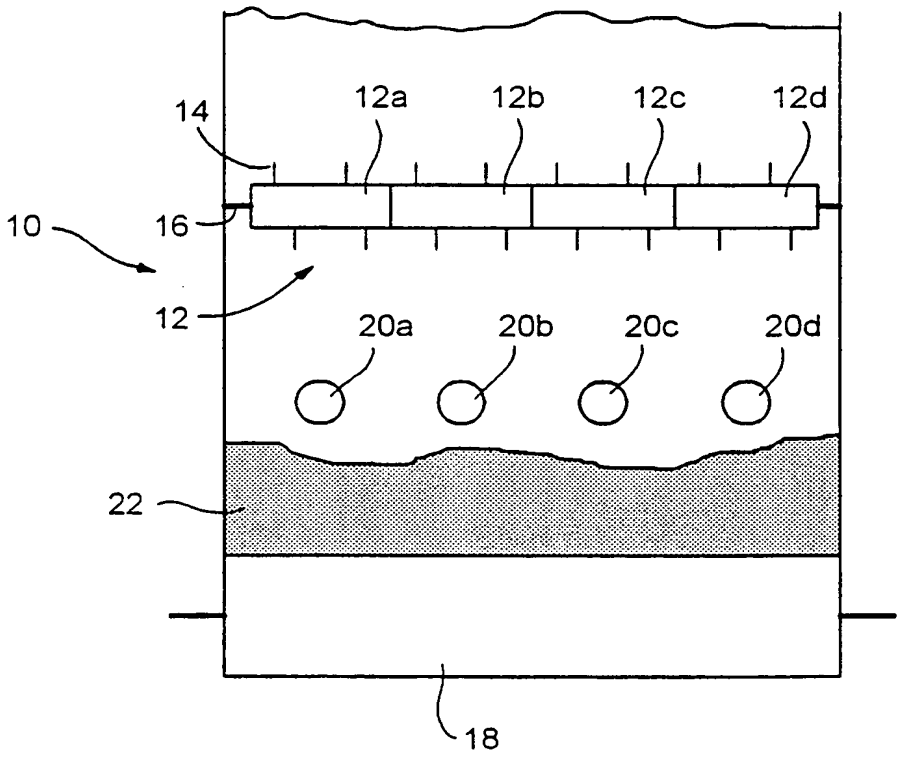


FIG. 2

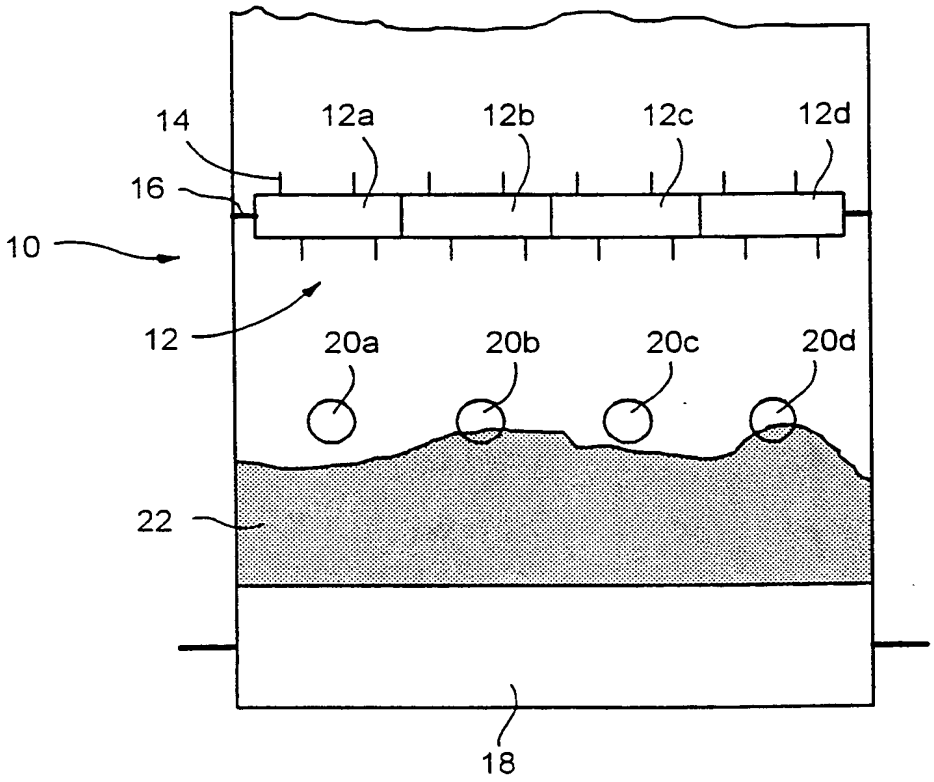


FIG. 3

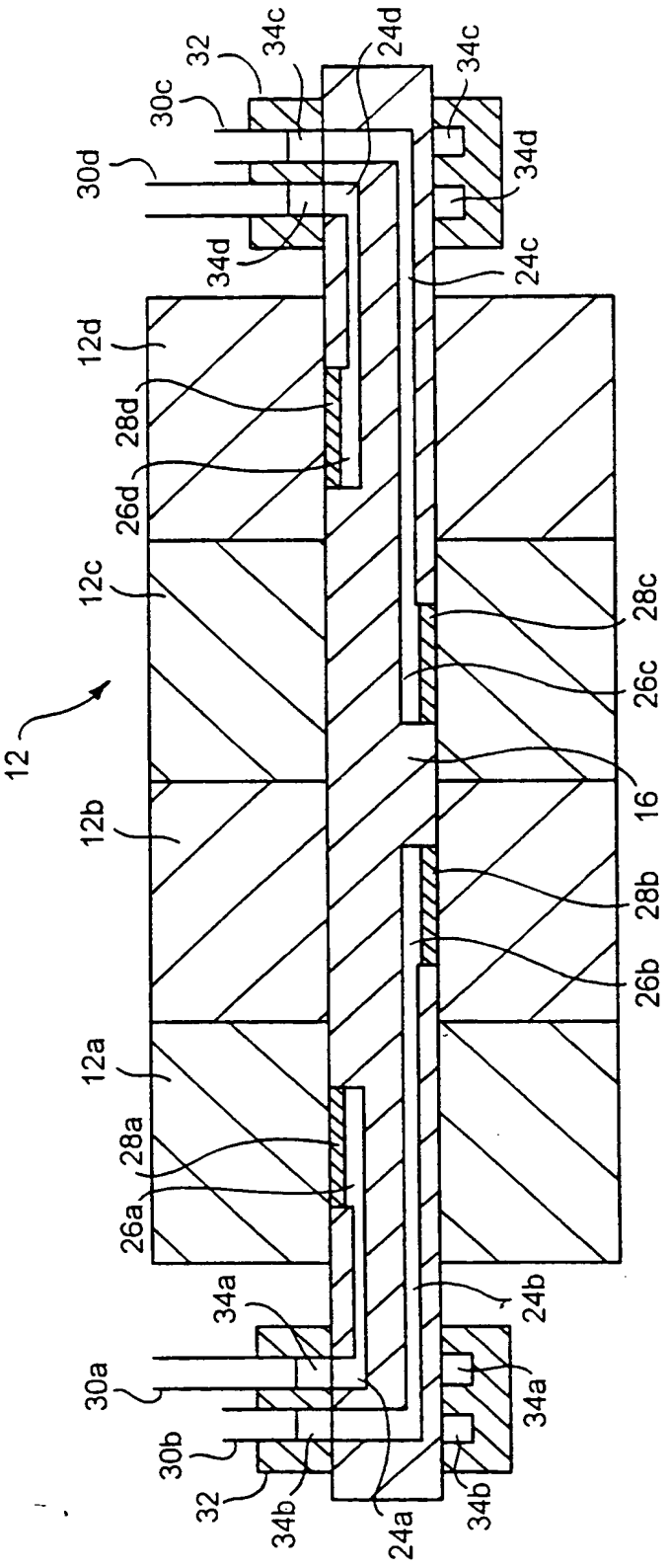

12
12a
12b
12c
12d
16
24a
24b
24c
24d
26a
26b
26c
26d
28a
28b
28c
28d
30a
30b
30c
30d
32
34a
34b
34c
34d

FIG. 4

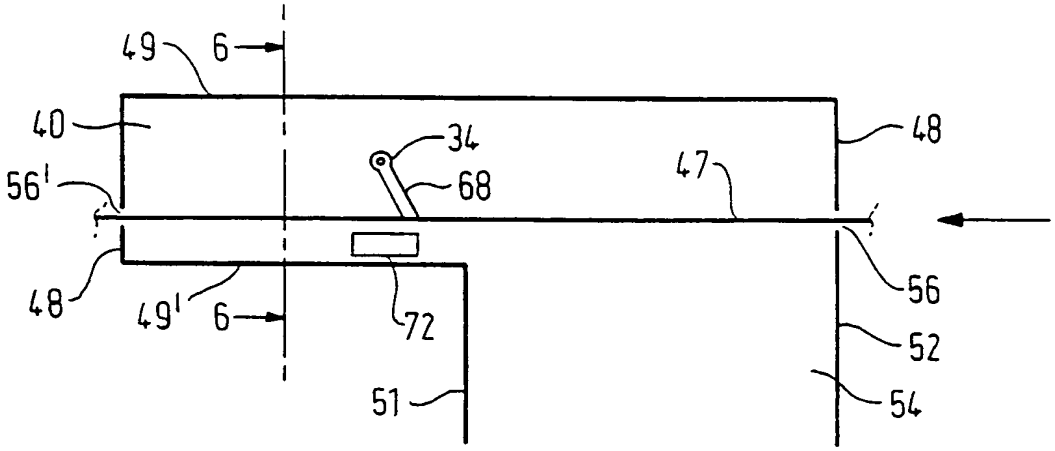

49
6
40
34
48
56'
68
47
48
49'
6
72
56
52
51
54

FIG.5

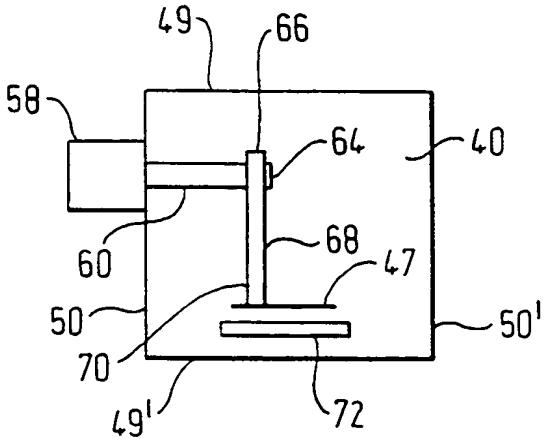

49
66
58
64
40
60
68
47
50
50'
70
49'
72

FIG.6

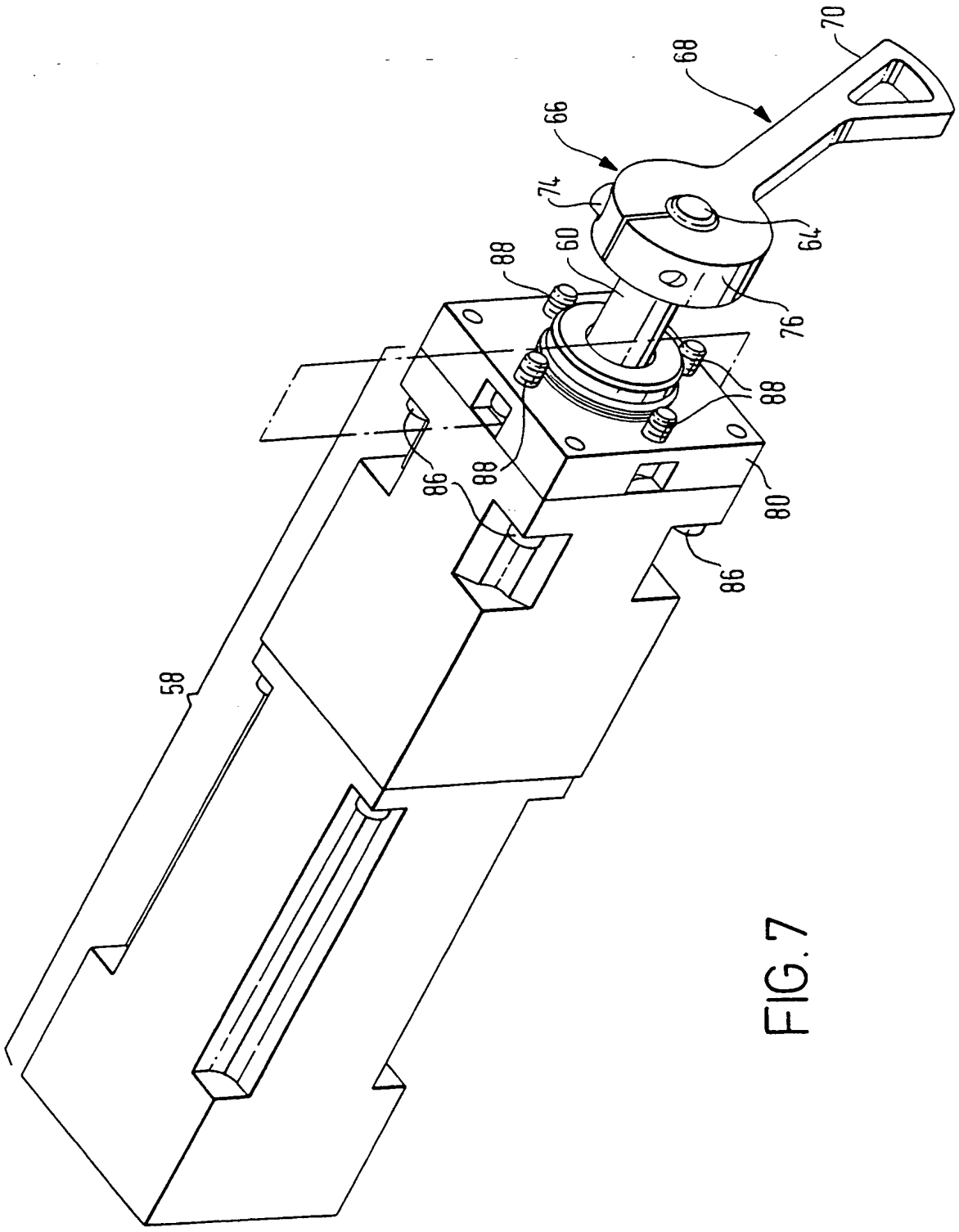
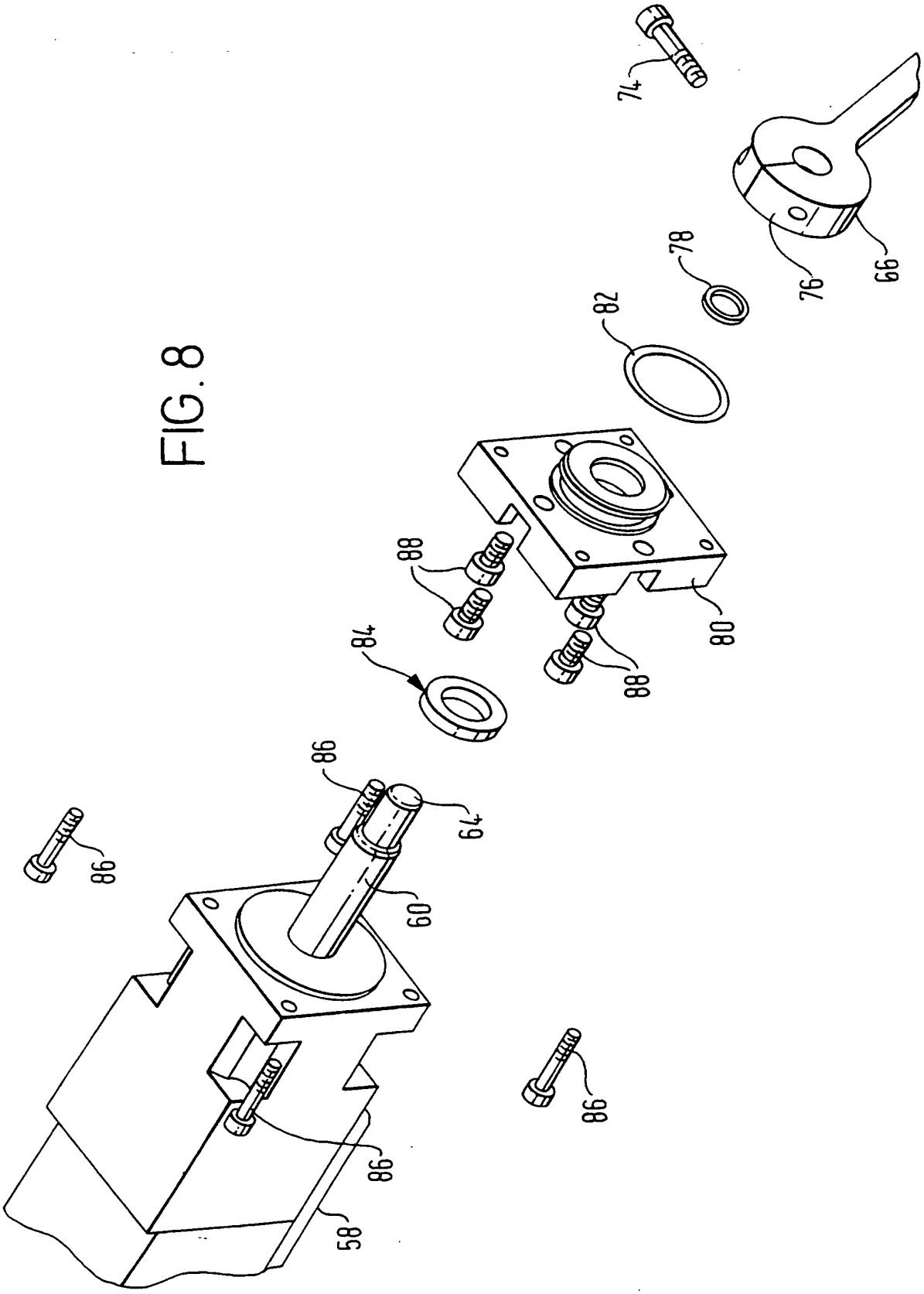


FIG. 7

FIG. 8



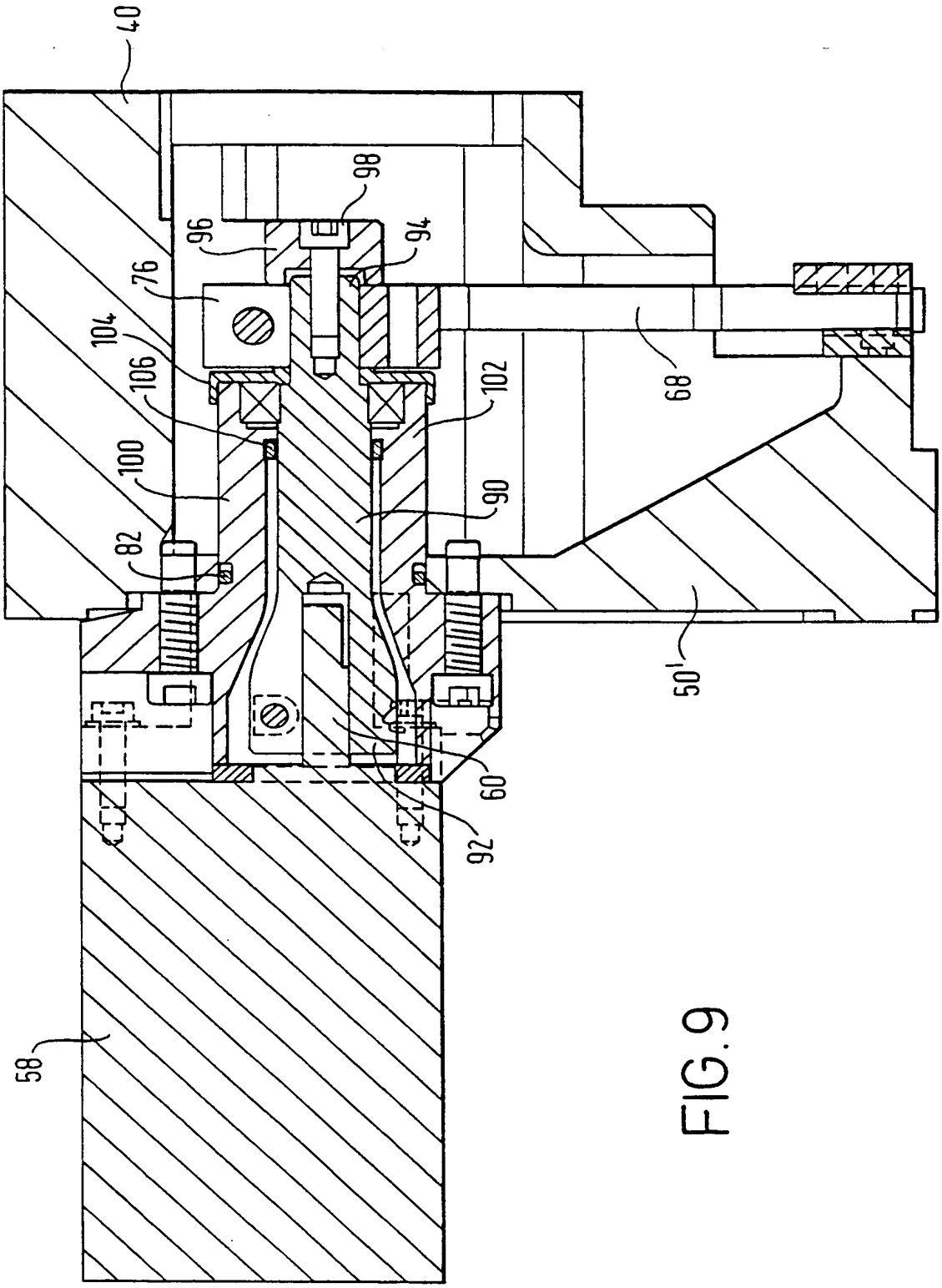


FIG.9

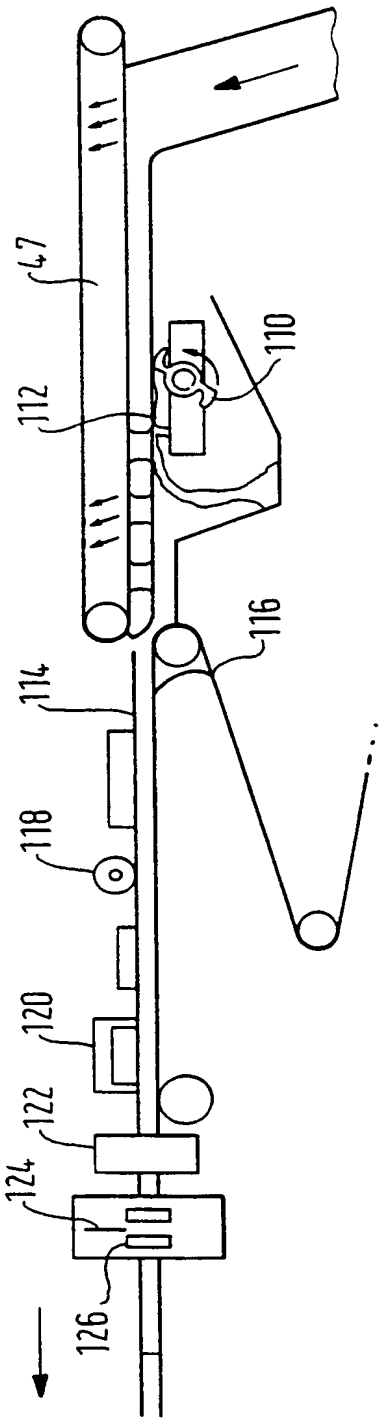


FIG. 10

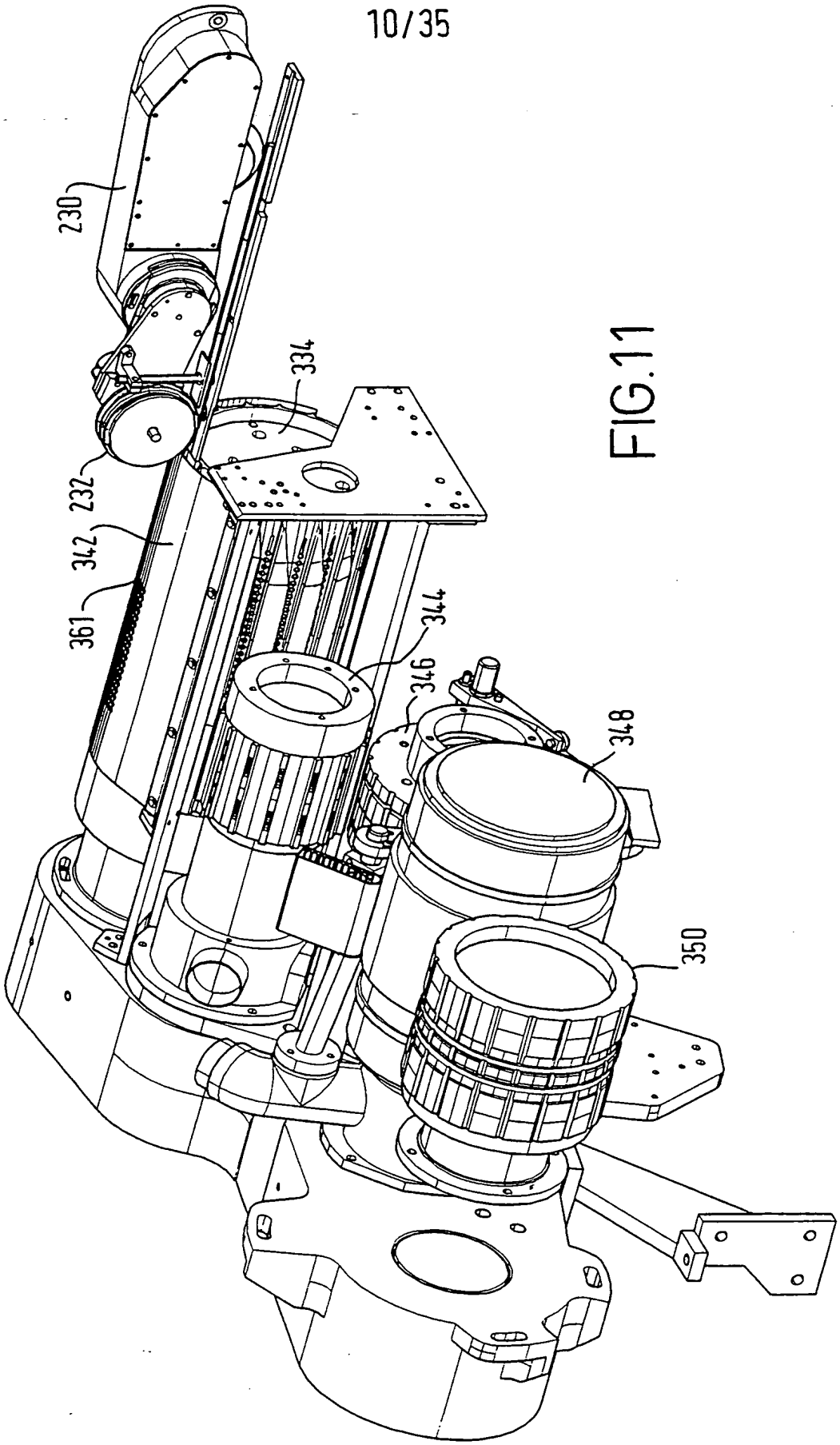


FIG.11

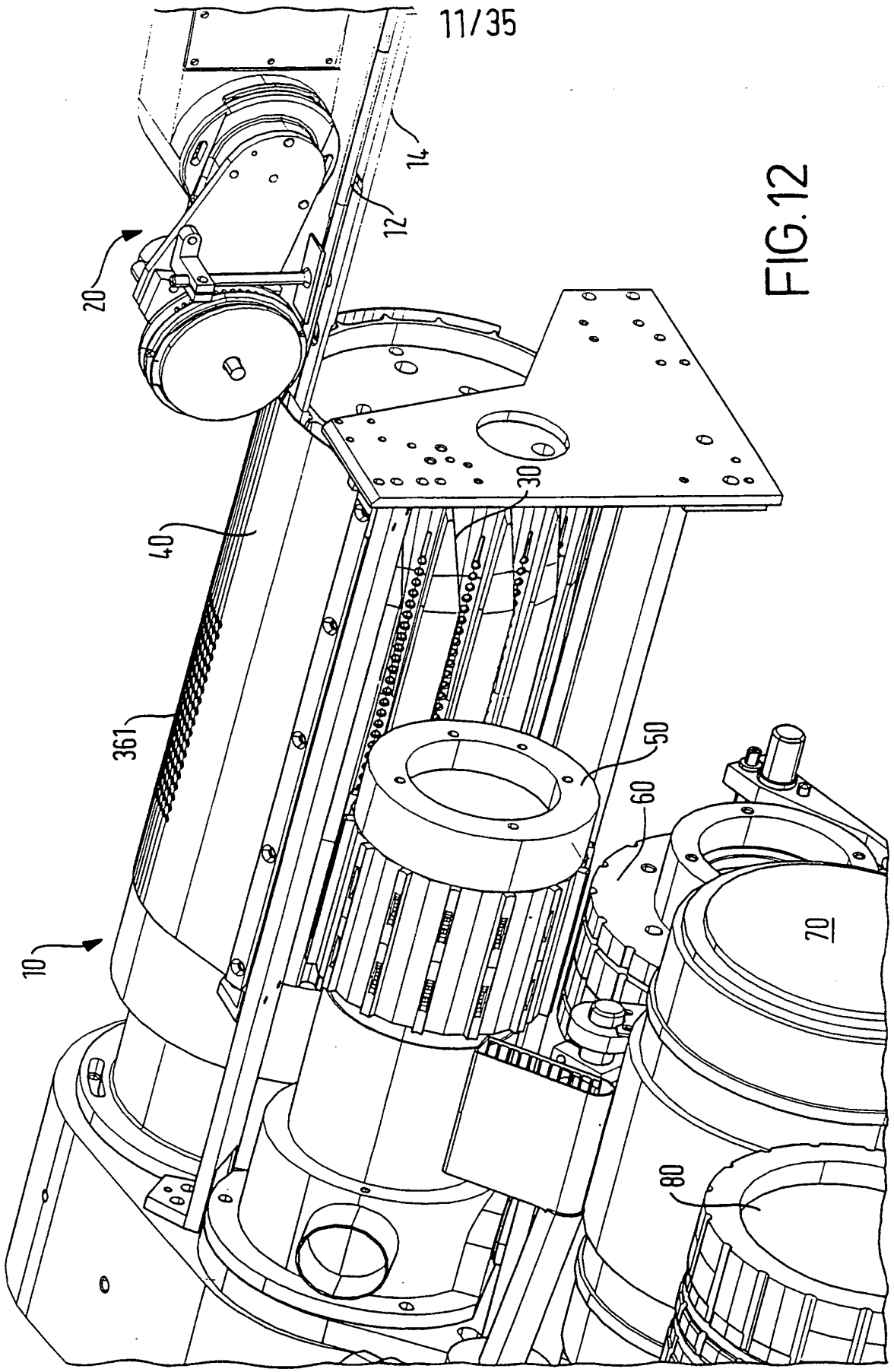


FIG.12

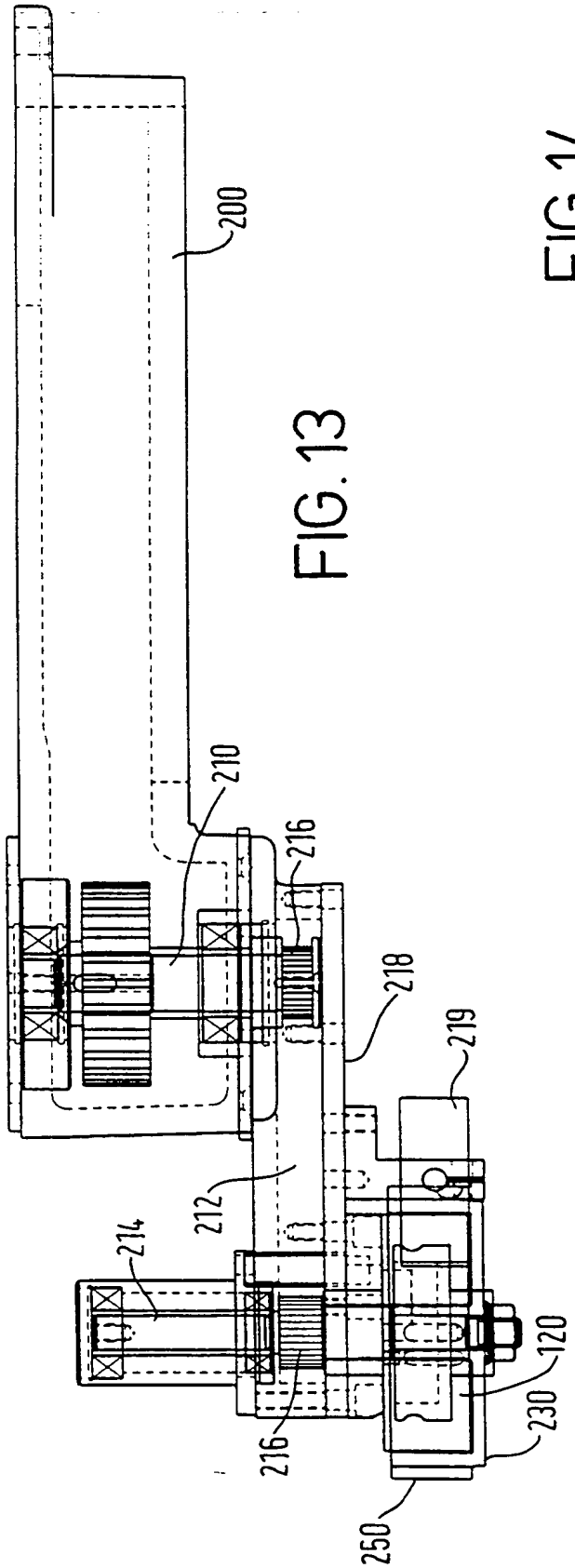
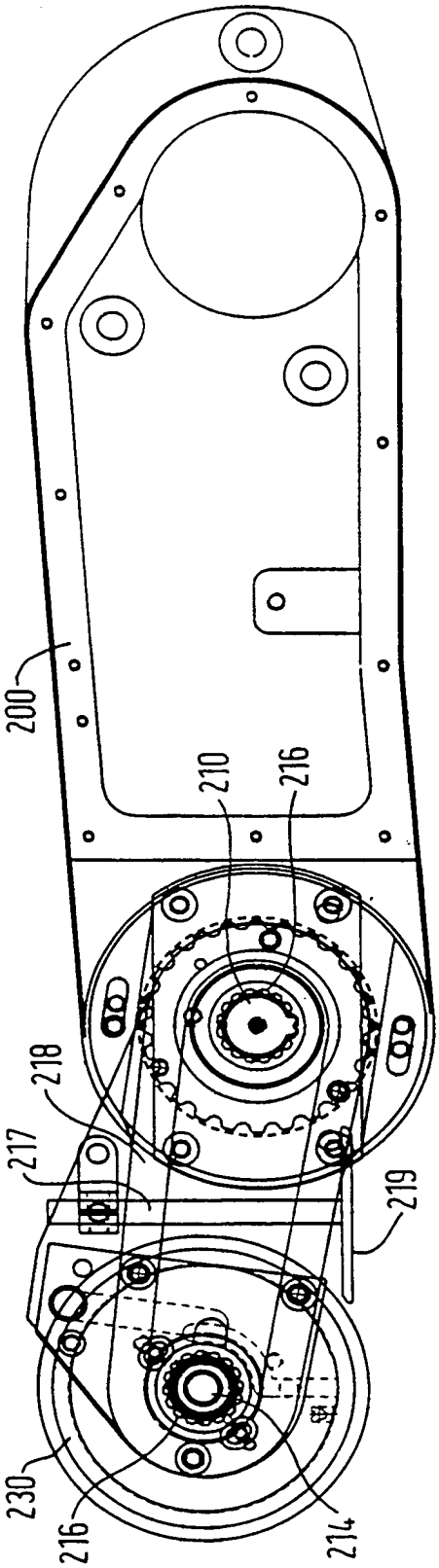

200
210
216
218
219
212
214
120
230
216
250

FIG. 13

FIG. 14


200
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230
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214

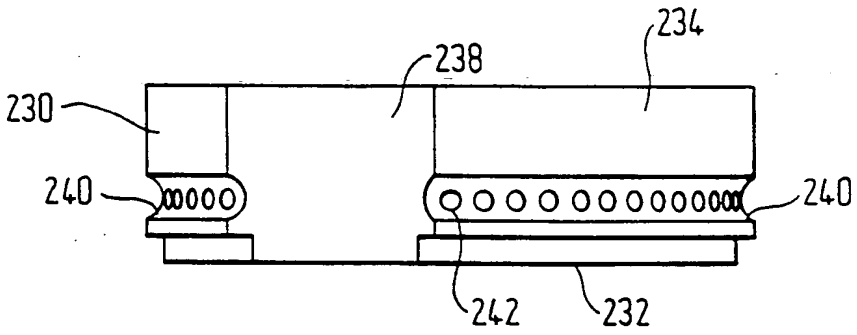


FIG. 15

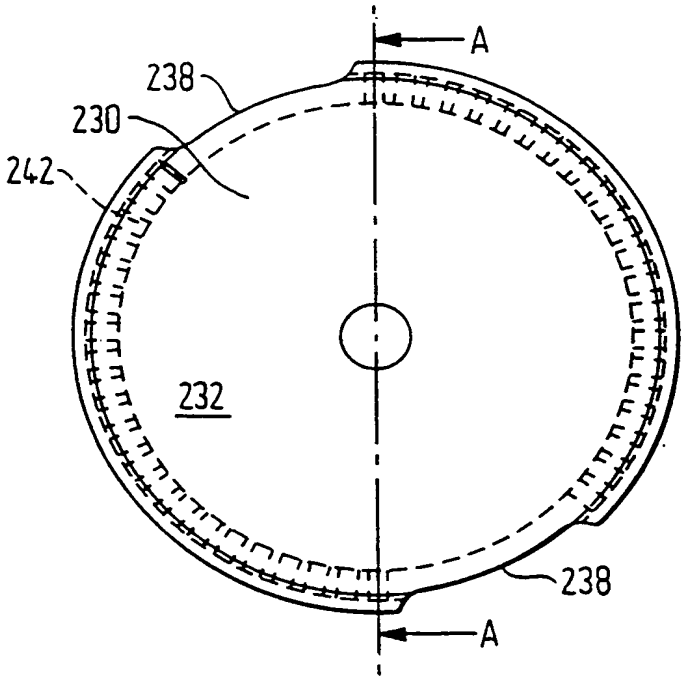


FIG. 16

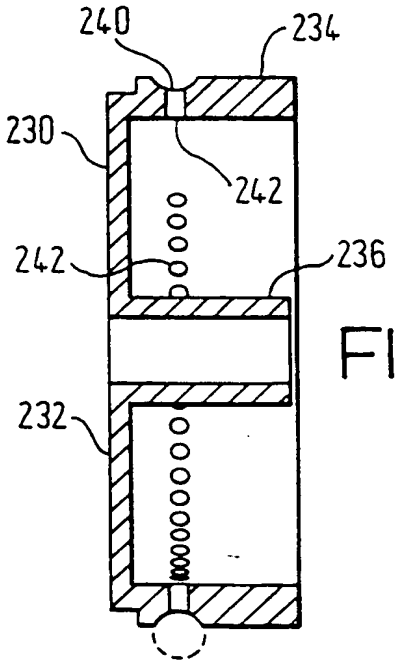


FIG. 17

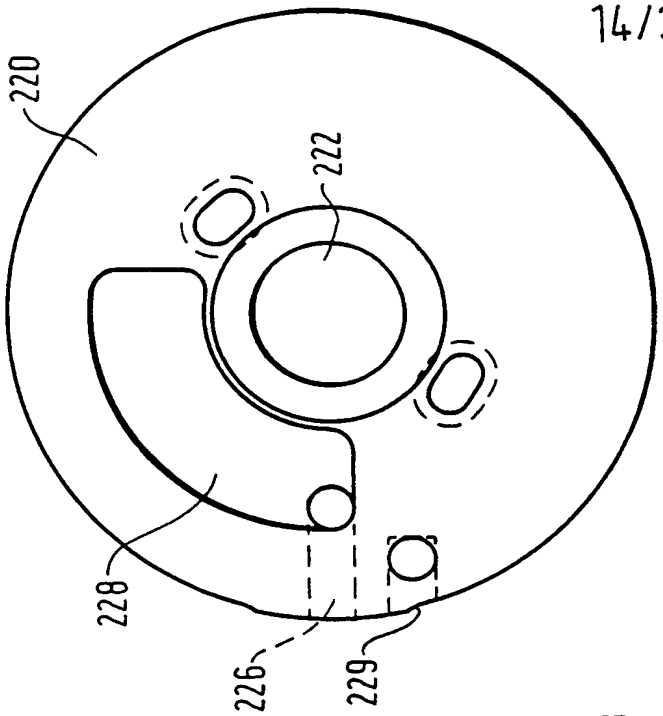


FIG. 20

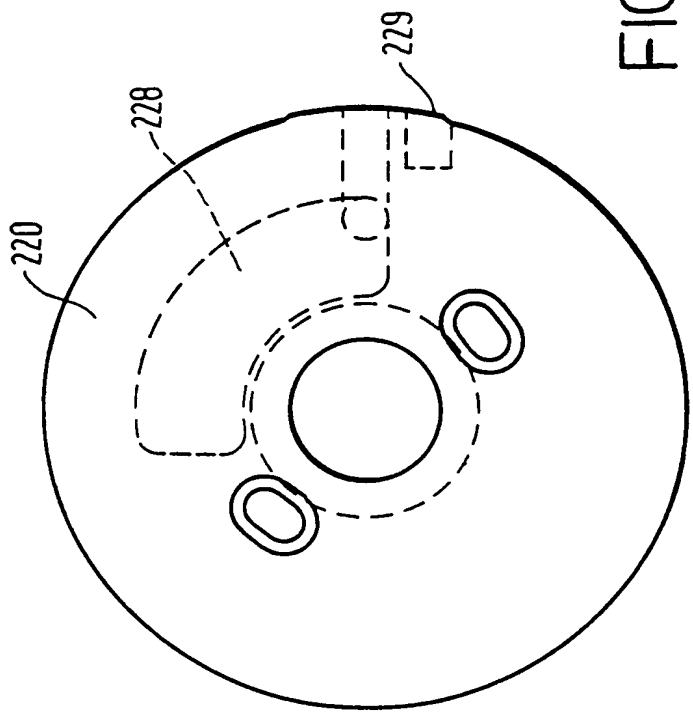


FIG. 19

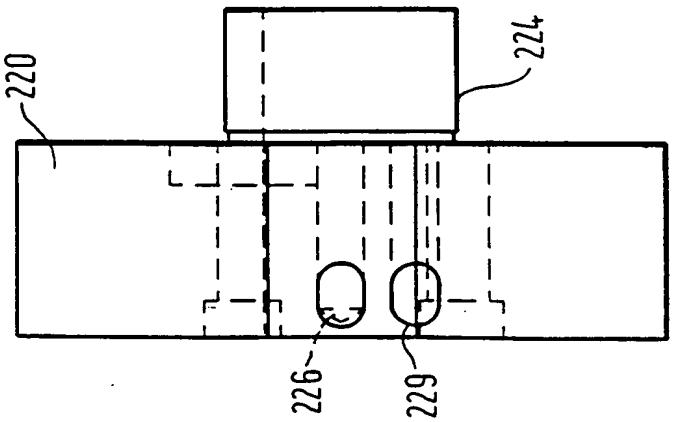


FIG. 18

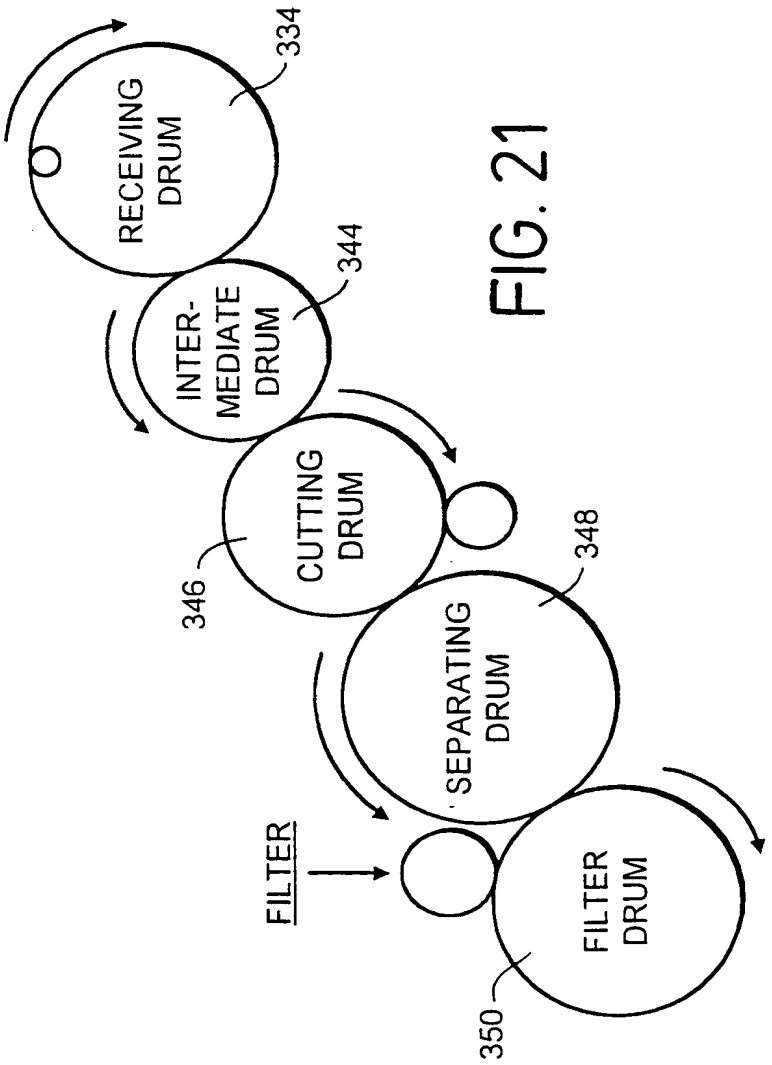
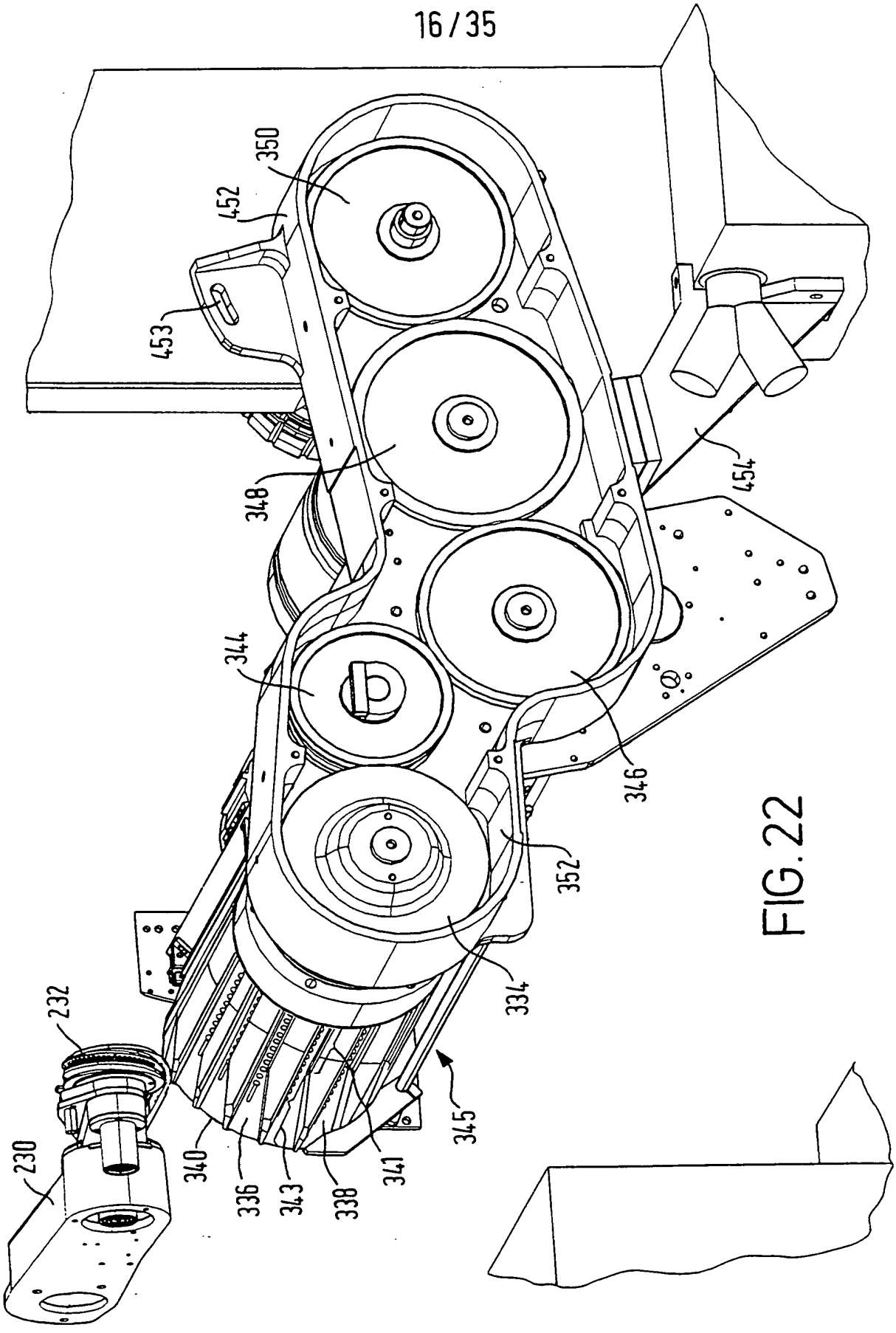

RECEIVING DRUM
334
INTER-MEDIATE DRUM
344
CUTTING DRUM
346
SEPARATING DRUM
348
FILTER
FILTER DRUM
350

FIG. 21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454
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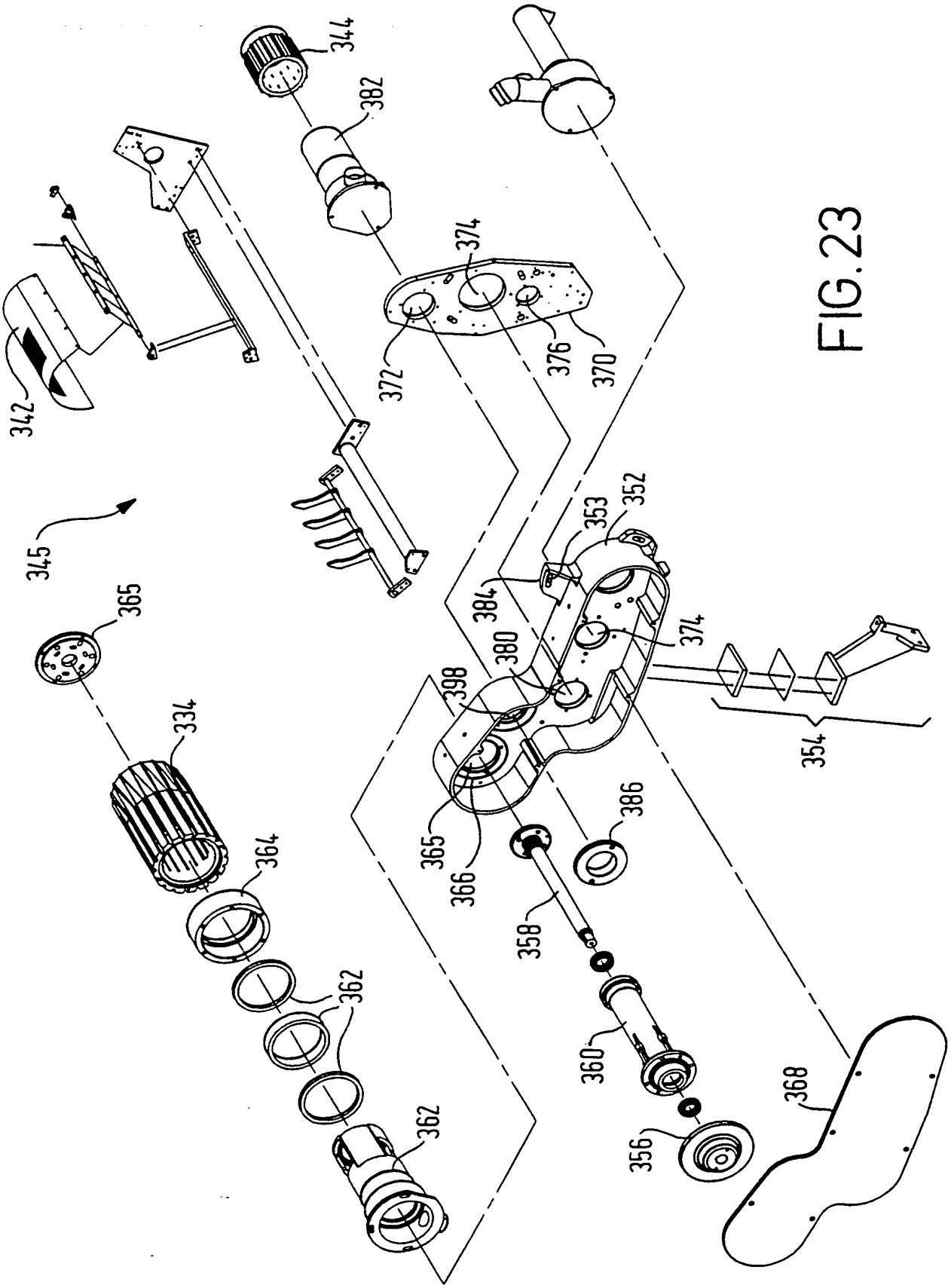
346
352
334
345
232
230
340
336
343
338
341

FIG. 22


344
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372
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370
342
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334
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374
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354
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366
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360
356
368

FIG. 23

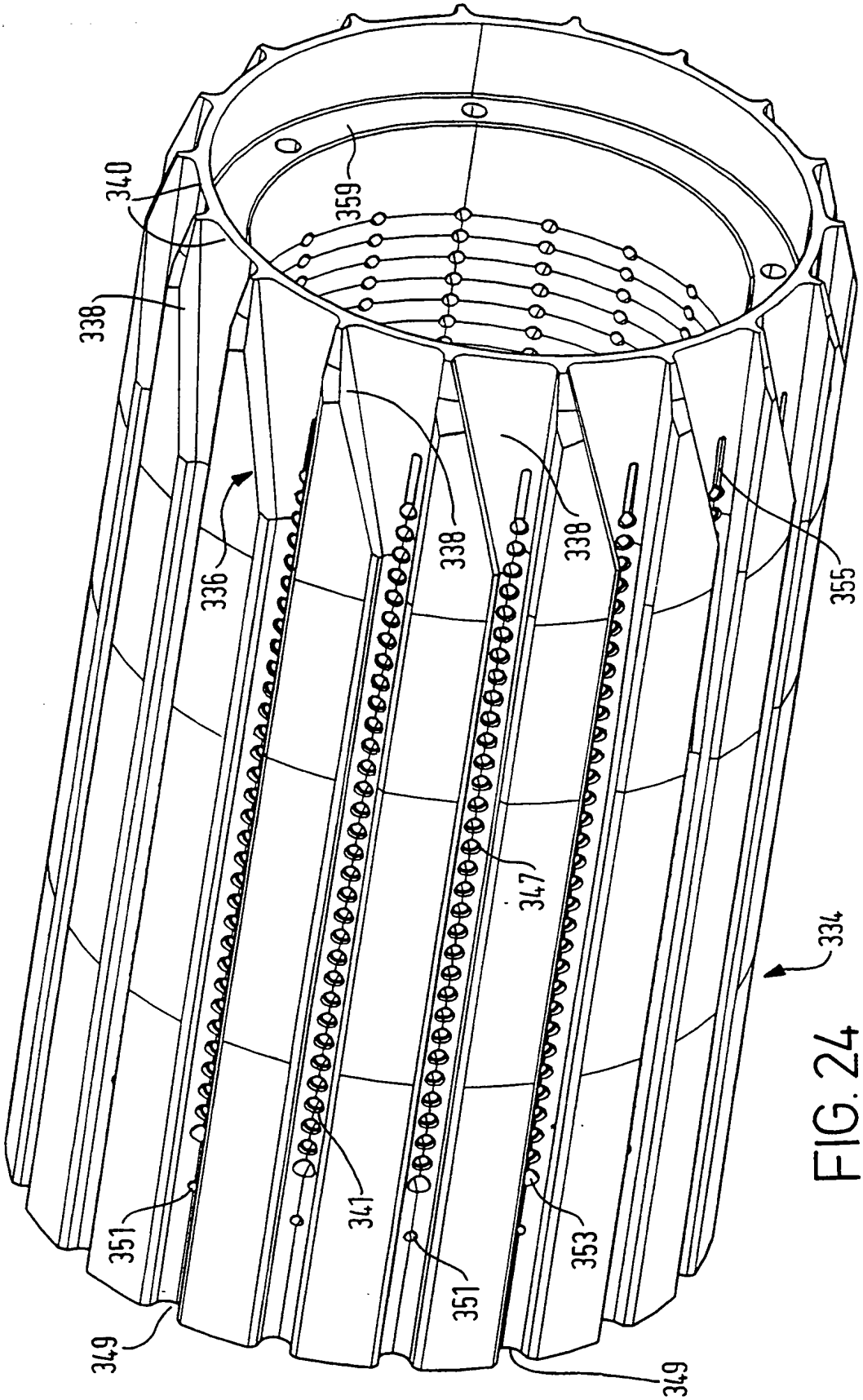
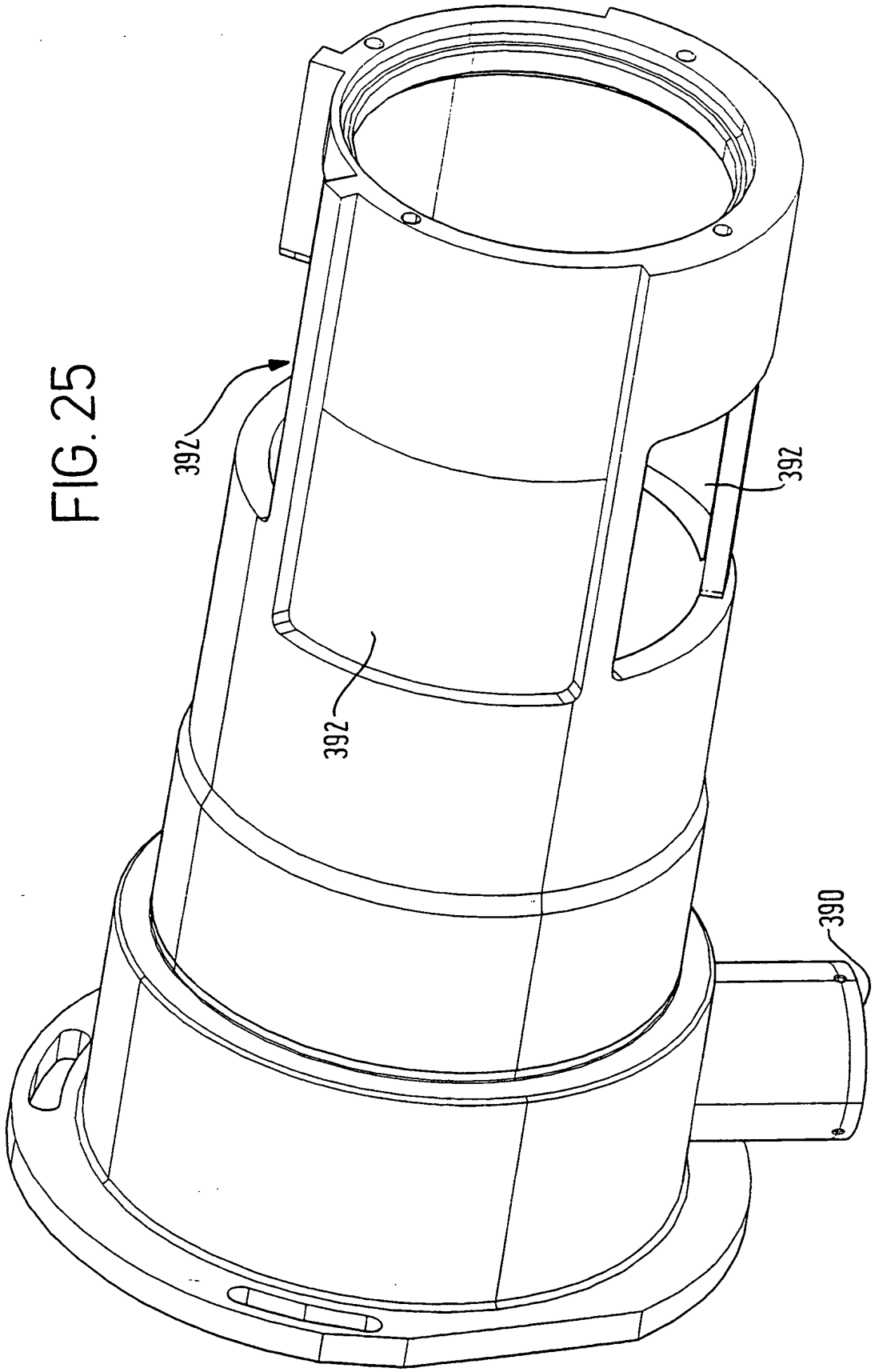


FIG. 24

FIG. 25



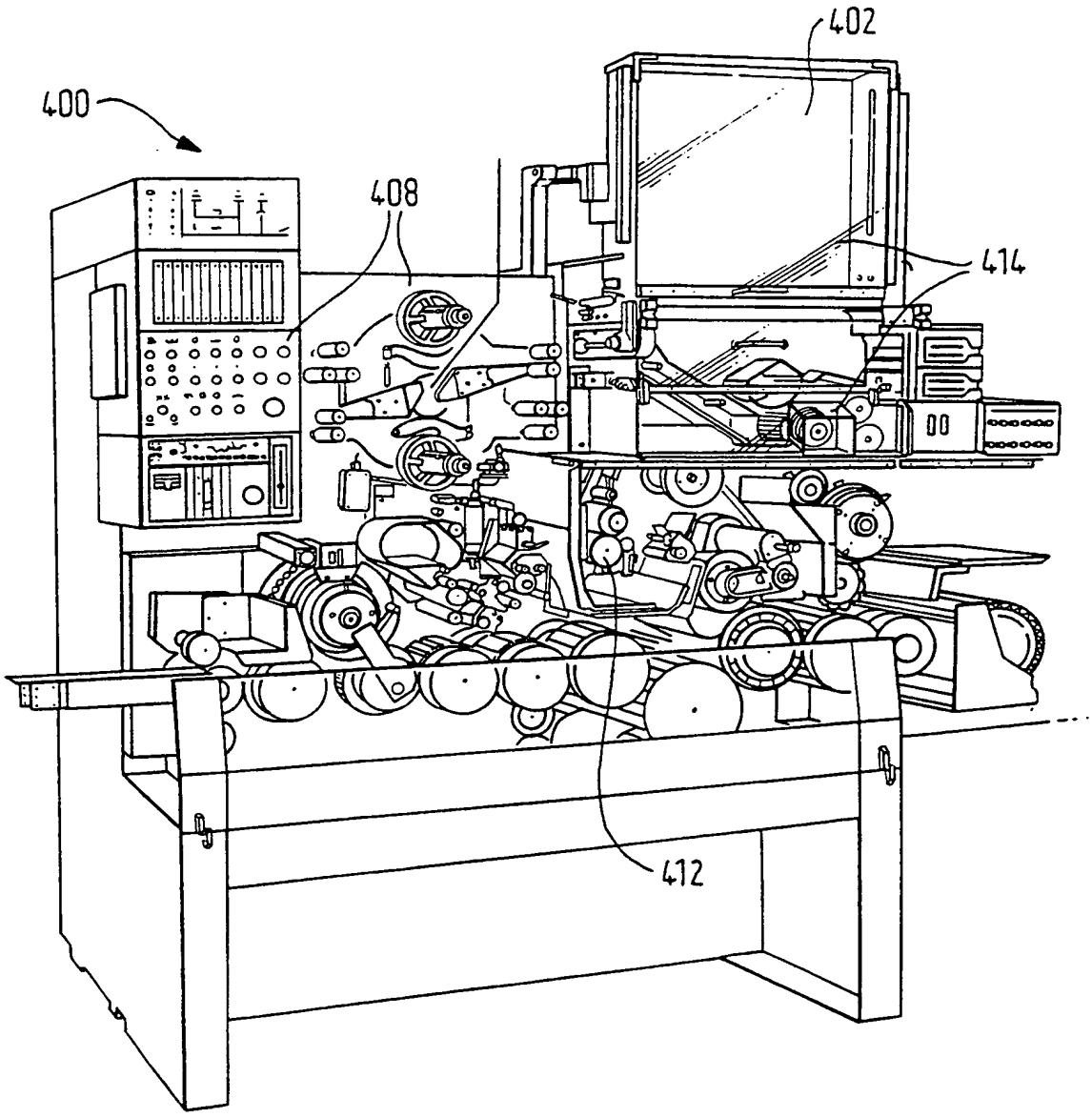


FIG. 26

FIG. 27

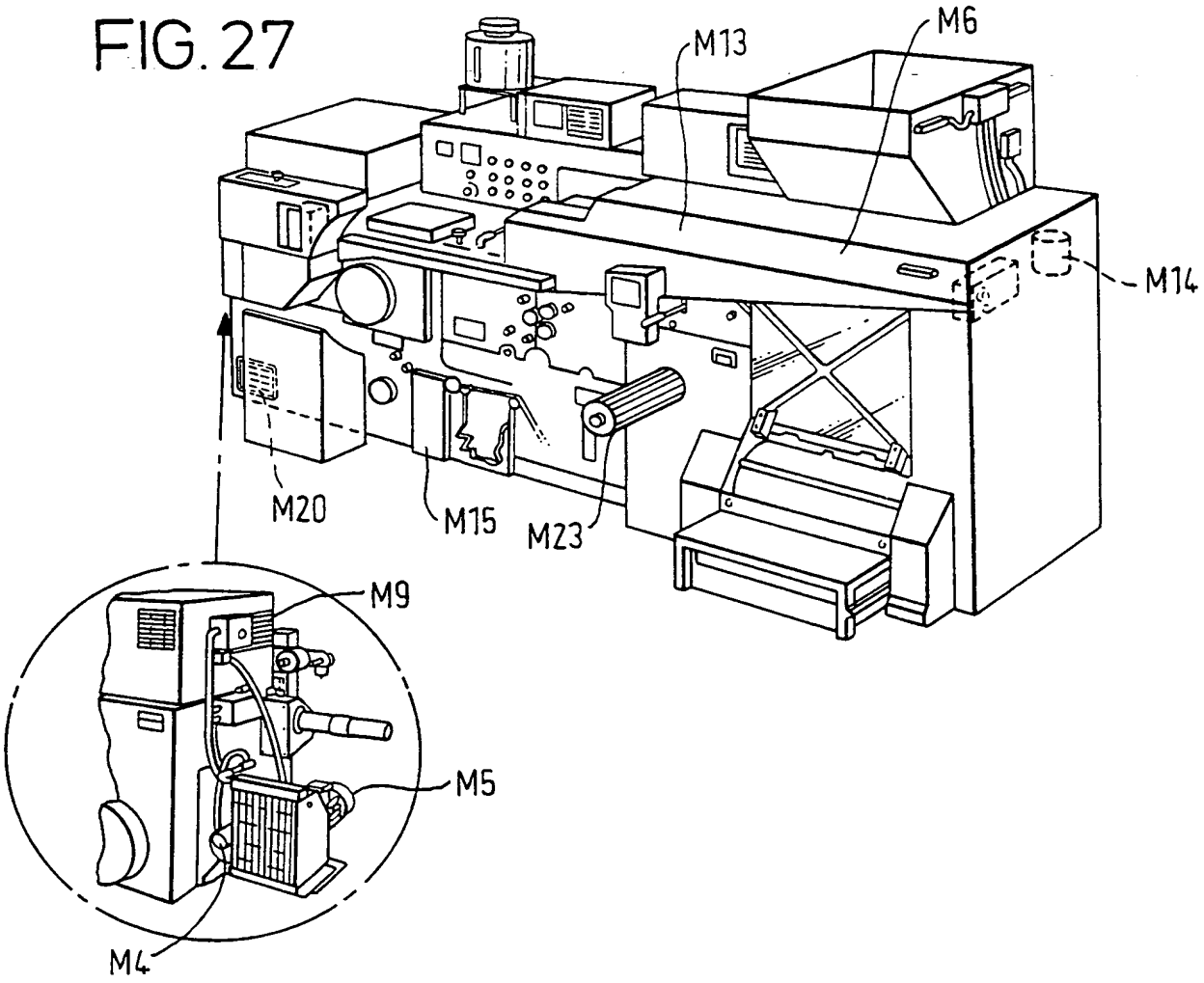
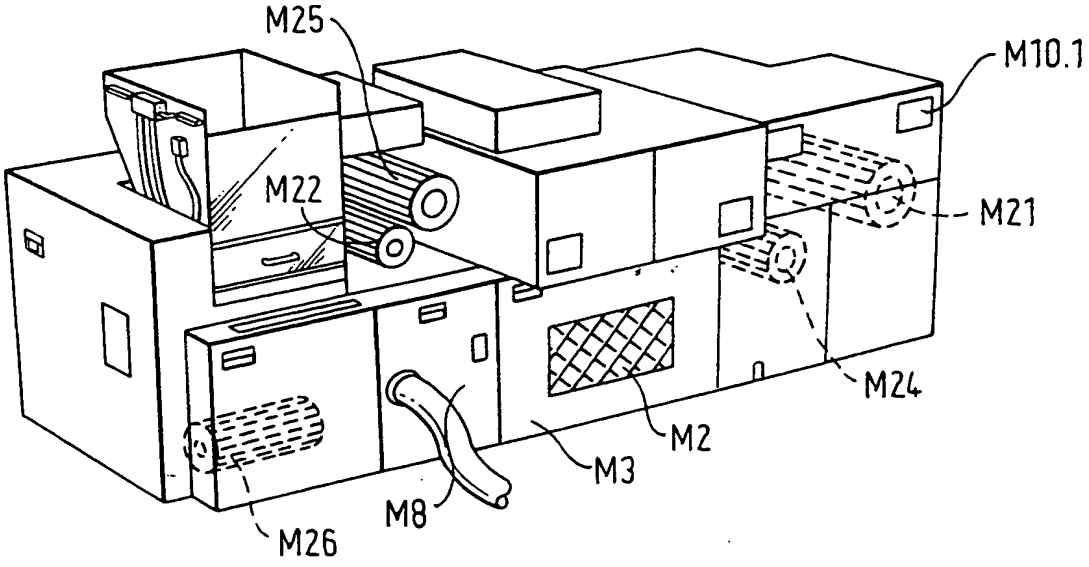


FIG. 28



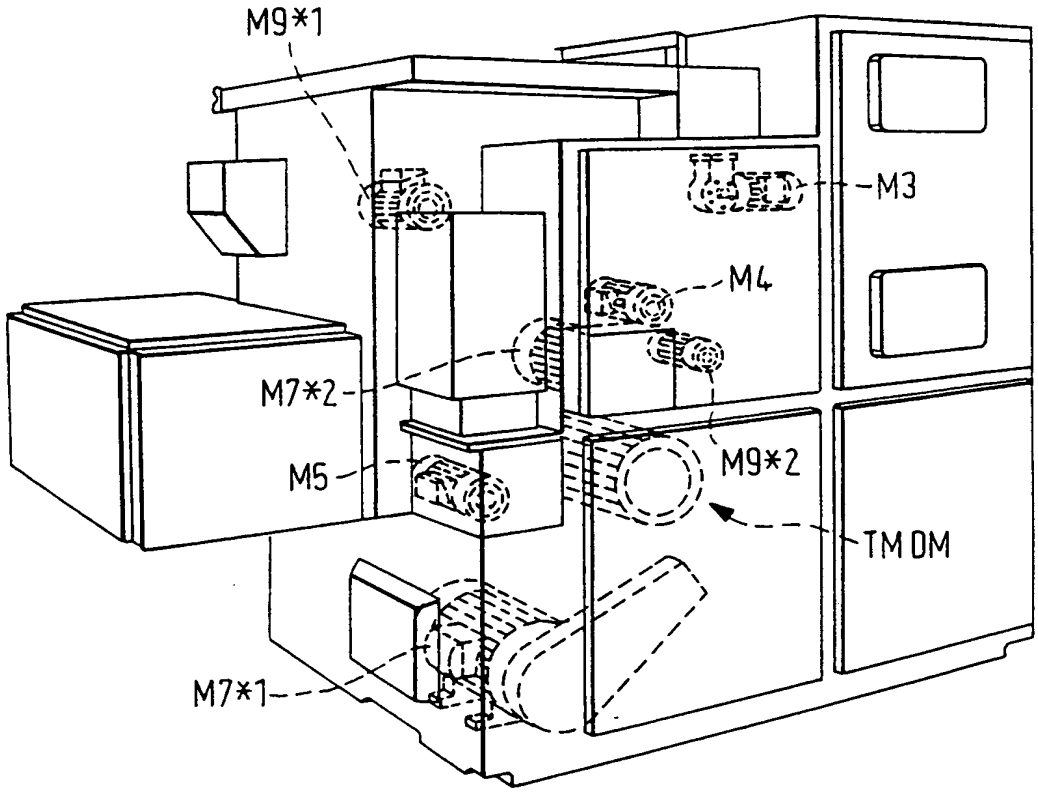


FIG. 29

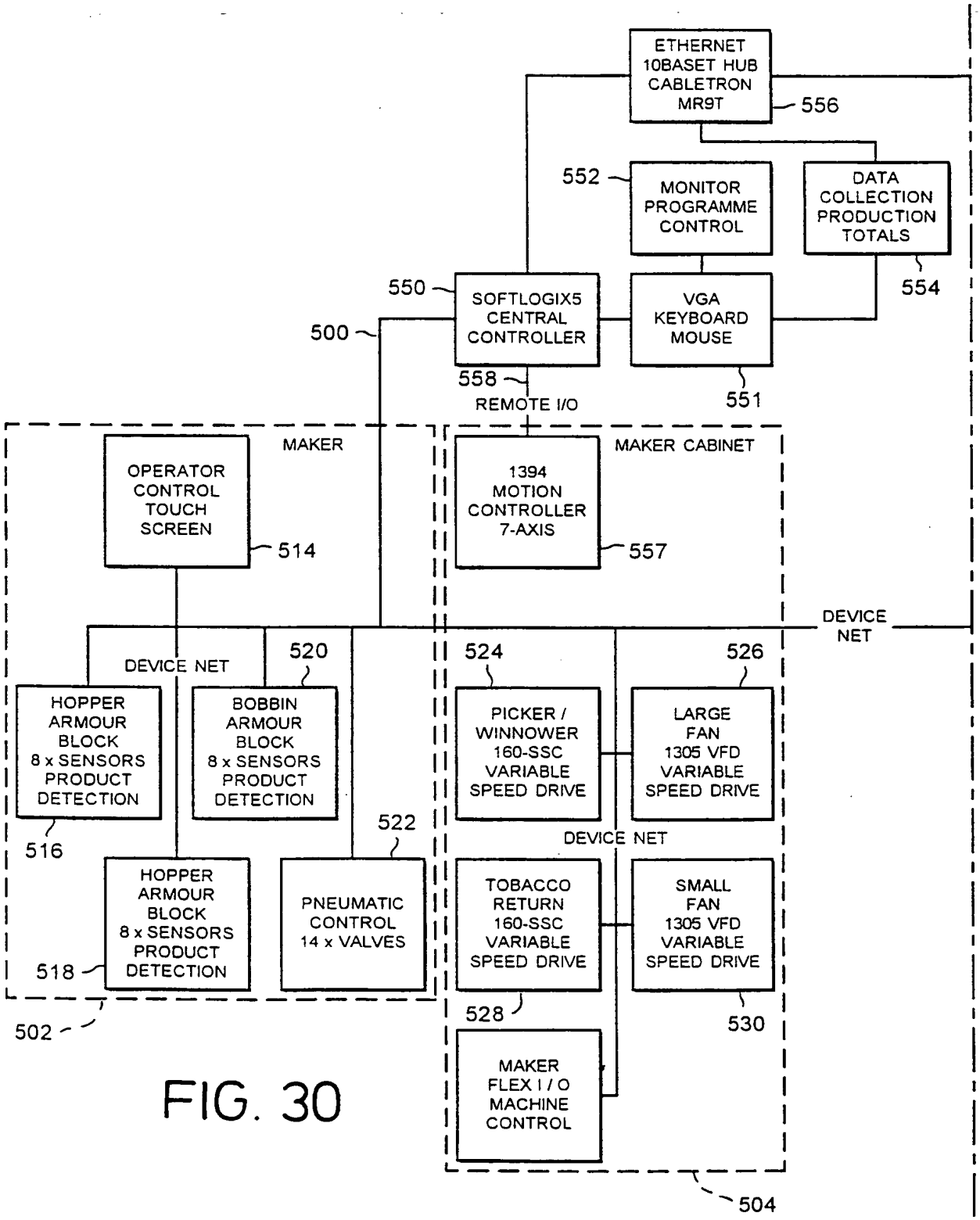

ETHERNET
10BASET HUB
CABLETRON
MR9T
556
552
MONITOR
PROGRAMME
CONTROL
DATA
COLLECTION
PRODUCTION
TOTALS
554
550
SOFTLOGIX5
CENTRAL
CONTROLLER
VGA
KEYBOARD
MOUSE
500
558
REMOTE I/O
551
MAKER
MAKER CABINET
OPERATOR
CONTROL
TOUCH
SCREEN
514
1394
MOTION
CONTROLLER
7-AXIS
557
DEVICE
NET
DEVICE NET
520
524
526
HOPPER
ARMOUR
BLOCK
8 x SENSORS
PRODUCT
DETECTION
BOBBIN
ARMOUR
BLOCK
8 x SENSORS
PRODUCT
DETECTION
PICKER /
WINNOWER
160-SSC
VARIABLE
SPEED DRIVE
LARGE
FAN
1305 VFD
VARIABLE
SPEED DRIVE
516
522
DEVICE NET
HOPPER
ARMOUR
BLOCK
8 x SENSORS
PRODUCT
DETECTION
PNEUMATIC
CONTROL
14 x VALVES
TOBACCO
RETURN
160-SSC
VARIABLE
SPEED DRIVE
SMALL
FAN
1305 VFD
VARIABLE
SPEED DRIVE
518
528
530
MAKER
FLEX I / O
MACHINE
CONTROL
502
504

FIG. 30

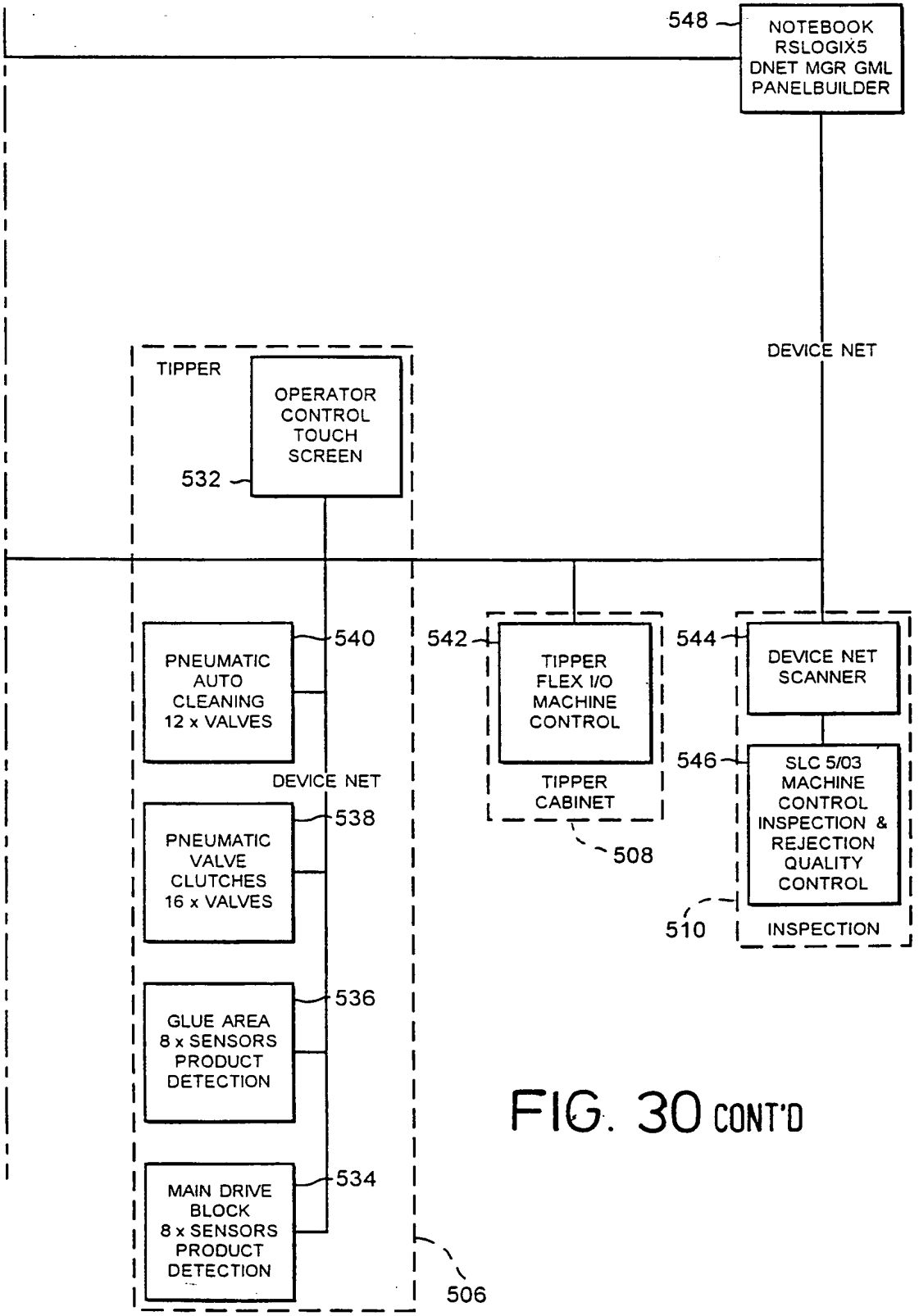
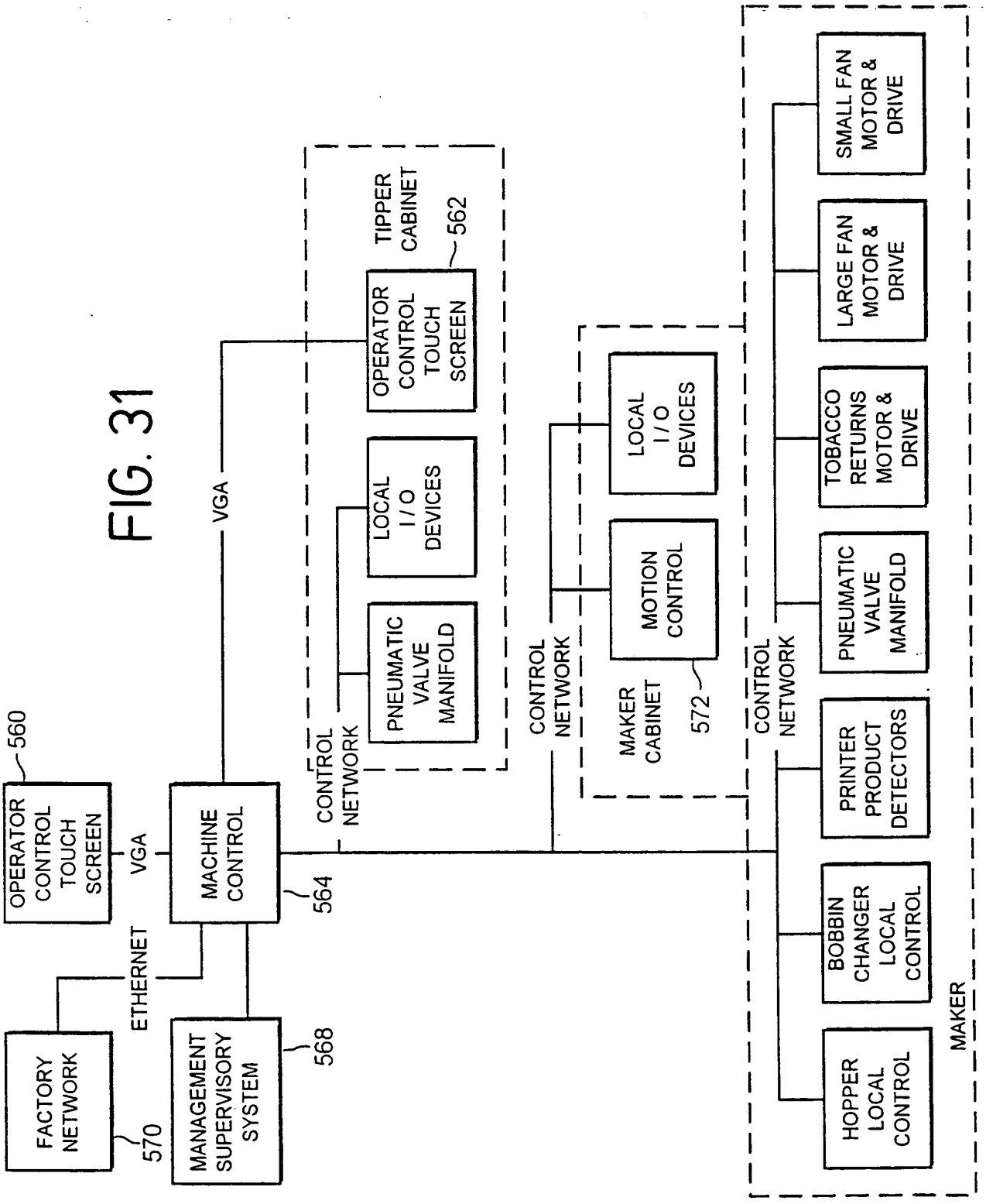

548
NOTEBOOK
RSLOGIX5
DNET MGR GML
PANELBUILDER
DEVICE NET
TIPPER
OPERATOR
CONTROL
TOUCH
SCREEN
532
PNEUMATIC
AUTO
CLEANING
12 x VALVES
540
DEVICE NET
PNEUMATIC
VALVE
CLUTCHES
16 x VALVES
538
GLUE AREA
8 x SENSORS
PRODUCT
DETECTION
536
MAIN DRIVE
BLOCK
8 x SENSORS
PRODUCT
DETECTION
534
506
542
TIPPER
FLEX I/O
MACHINE
CONTROL
TIPPER
CABINET
508
544
DEVICE NET
SCANNER
546
SLC 5/03
MACHINE
CONTROL
INSPECTION &
REJECTION
QUALITY
CONTROL
510
INSPECTION

FIG. 30 CONT'D

FIG. 31


OPERATOR CONTROL TOUCH SCREEN
560
VGA
ETHERNET
FACTORY NETWORK
570
MANAGEMENT SUPERVISORY SYSTEM
568
MACHINE CONTROL
564
VGA
CONTROL NETWORK
TIPPER CABINET
562
OPERATOR CONTROL TOUCH SCREEN
LOCAL I/O DEVICES
PNEUMATIC VALVE MANIFOLD
CONTROL NETWORK
MAKER CABINET
572
MOTION CONTROL
LOCAL I/O DEVICES
CONTROL NETWORK
MAKER
HOPPER LOCAL CONTROL
BOBBIN CHANGER LOCAL CONTROL
PRINTER PRODUCT DETECTORS
PNEUMATIC VALVE MANIFOLD
TOBACCO RETURNS MOTOR & DRIVE
LARGE FAN MOTOR & DRIVE
SMALL FAN MOTOR & DRIVE

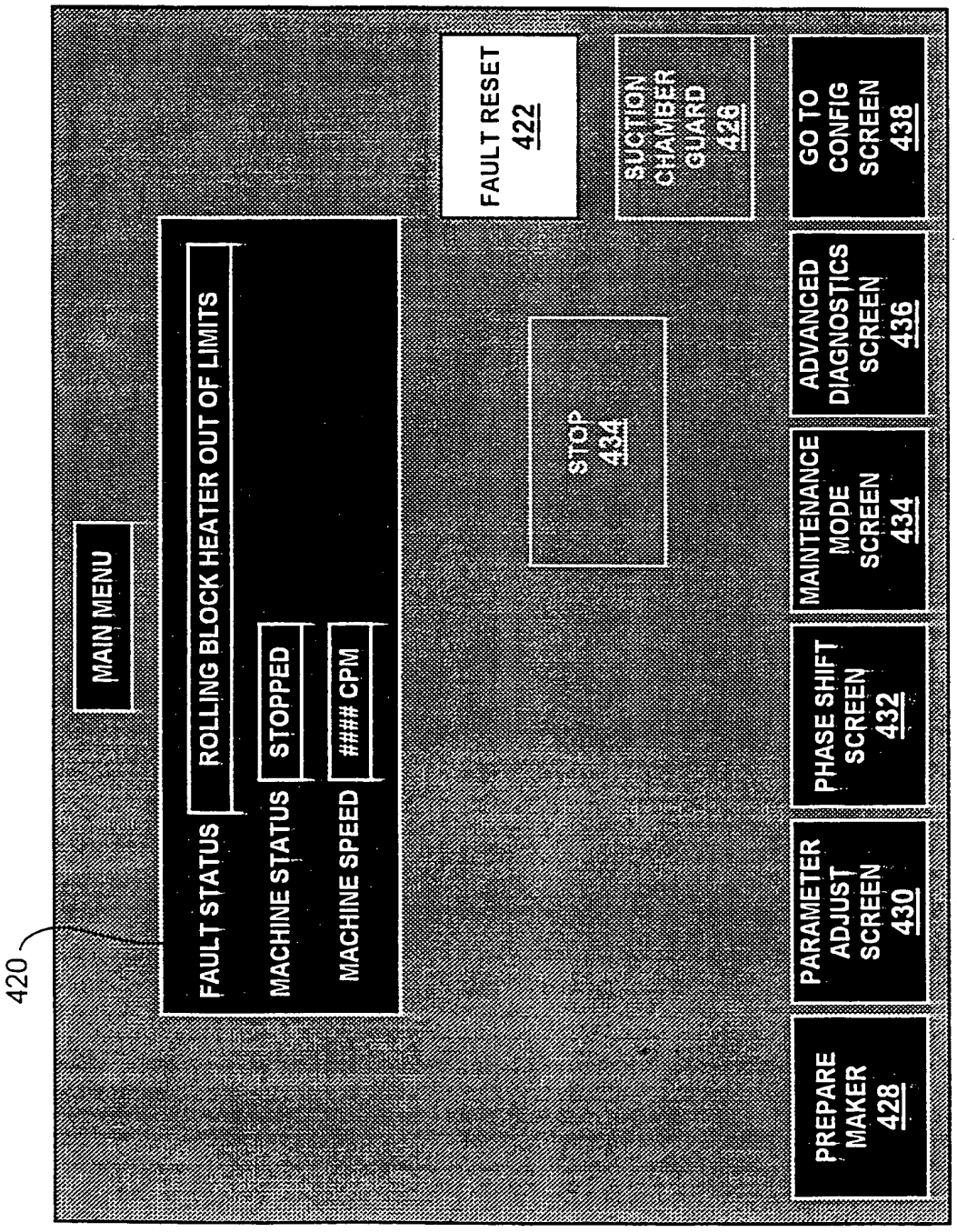

420
MAIN MENU
FAULT STATUS
ROLLING BLOCK HEATER OUT OF LIMITS
MACHINE STATUS
STOPPED
MACHINE SPEED
CPM
FAULT RESET 422
SUCTION CHAMBER GUARD 426
GO TO CONFIG SCREEN 438
ADVANCED DIAGNOSTICS SCREEN 436
STOP 434
MAINTENANCE MODE SCREEN 434
PHASE SHIFT SCREEN 432
PARAMETER ADJUST SCREEN 430
PREPARE MAKER 428

FIG. 32

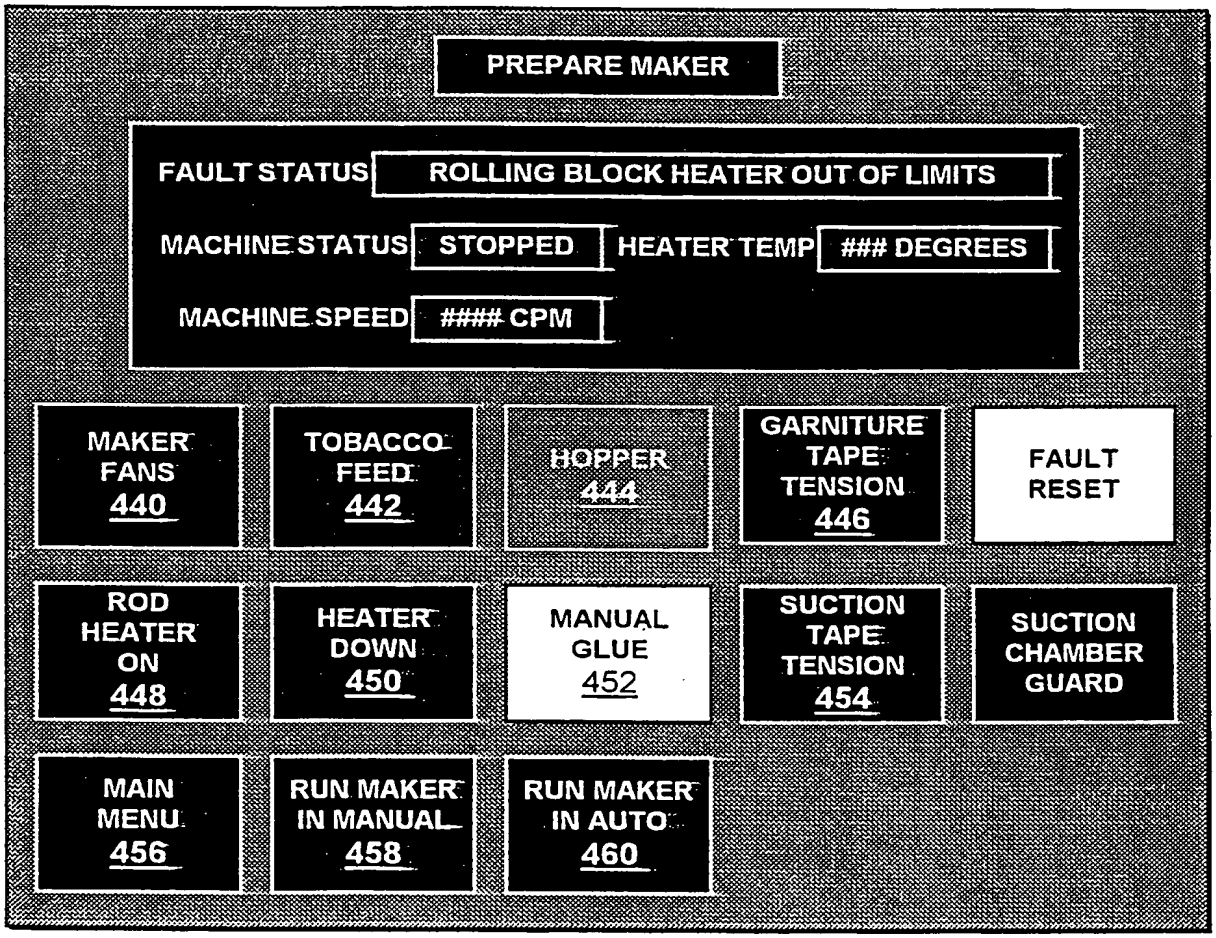

PREPARE MAKER
FAULT STATUS
ROLLING BLOCK HEATER OUT OF LIMITS
MACHINE STATUS
STOPPED
HEATER TEMP
DEGREES
MACHINE SPEED
CPM
MAKER FANS 440
TOBACCO FEED 442
HOPPER 444
GARNITURE TAPE TENSION 446
FAULT RESET
ROD HEATER ON 448
HEATER DOWN 450
MANUAL GLUE 452
SUCTION TAPE TENSION 454
SUCTION CHAMBER GUARD
MAIN MENU 456
RUN MAKER IN MANUAL 458
RUN MAKER IN AUTO 460

FIG. 33

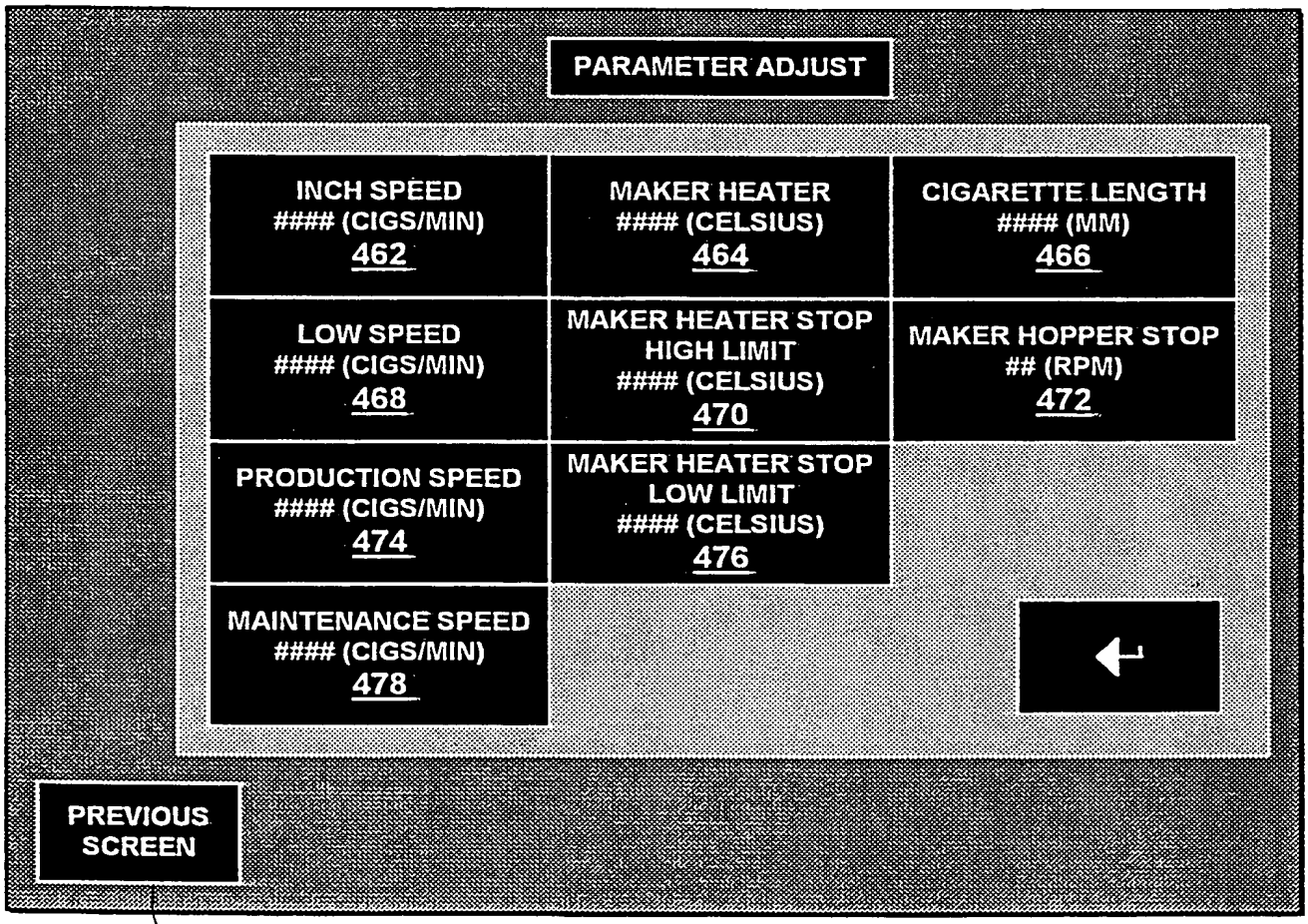

PARAMETER ADJUST
INCH SPEED
(CIGS/MIN)
462
MAKER HEATER
(CELSIUS)
464
CIGARETTE LENGTH
(MM)
466
LOW SPEED
(CIGS/MIN)
468
MAKER HEATER STOP
HIGH LIMIT
(CELSIUS)
470
MAKER HOPPER STOP
(RPM)
472
PRODUCTION SPEED
(CIGS/MIN)
474
MAKER HEATER STOP
LOW LIMIT
(CELSIUS)
476
MAINTENANCE SPEED
(CIGS/MIN)
478
PREVIOUS
SCREEN
480

FIG. 34

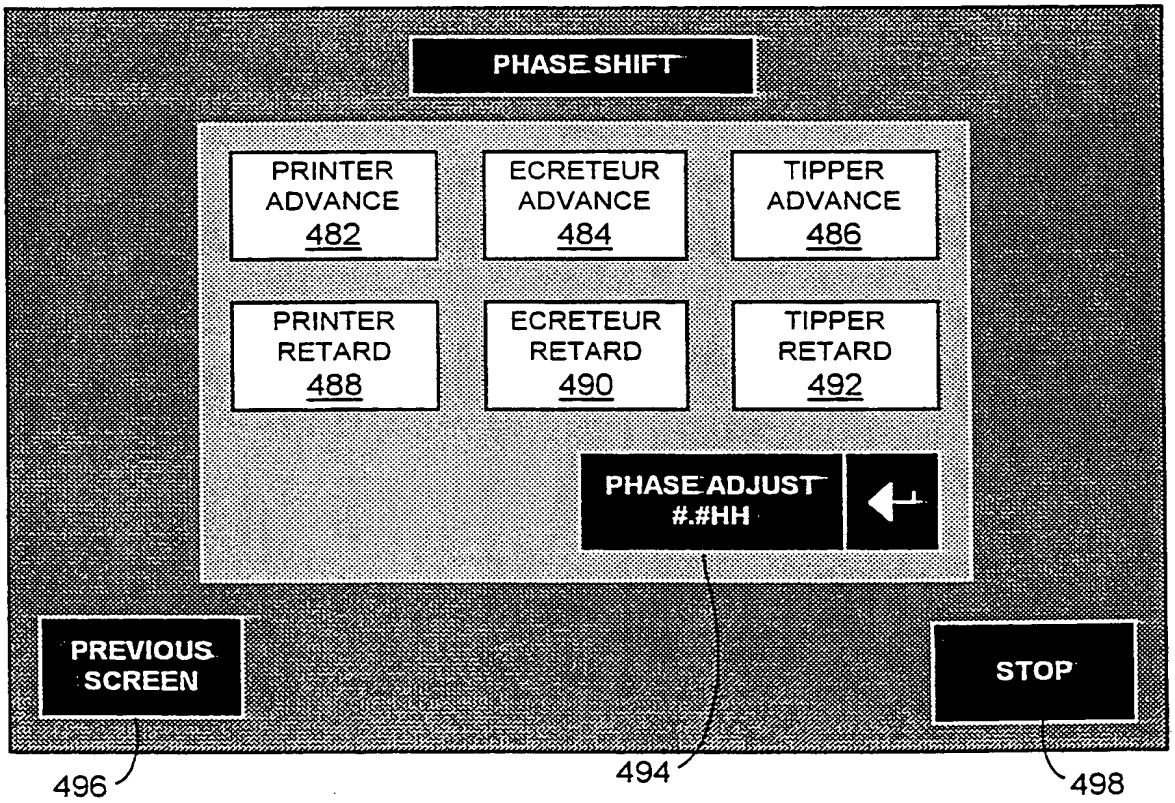

PHASE SHIFT
PRINTER ADVANCE 482
ECRETEUR ADVANCE 484
TIPPER ADVANCE 486
PRINTER RETARD 488
ECRETEUR RETARD 490
TIPPER RETARD 492
PHASE ADJUST #.#HH
PREVIOUS SCREEN
STOP
496
494
498

FIG. 35

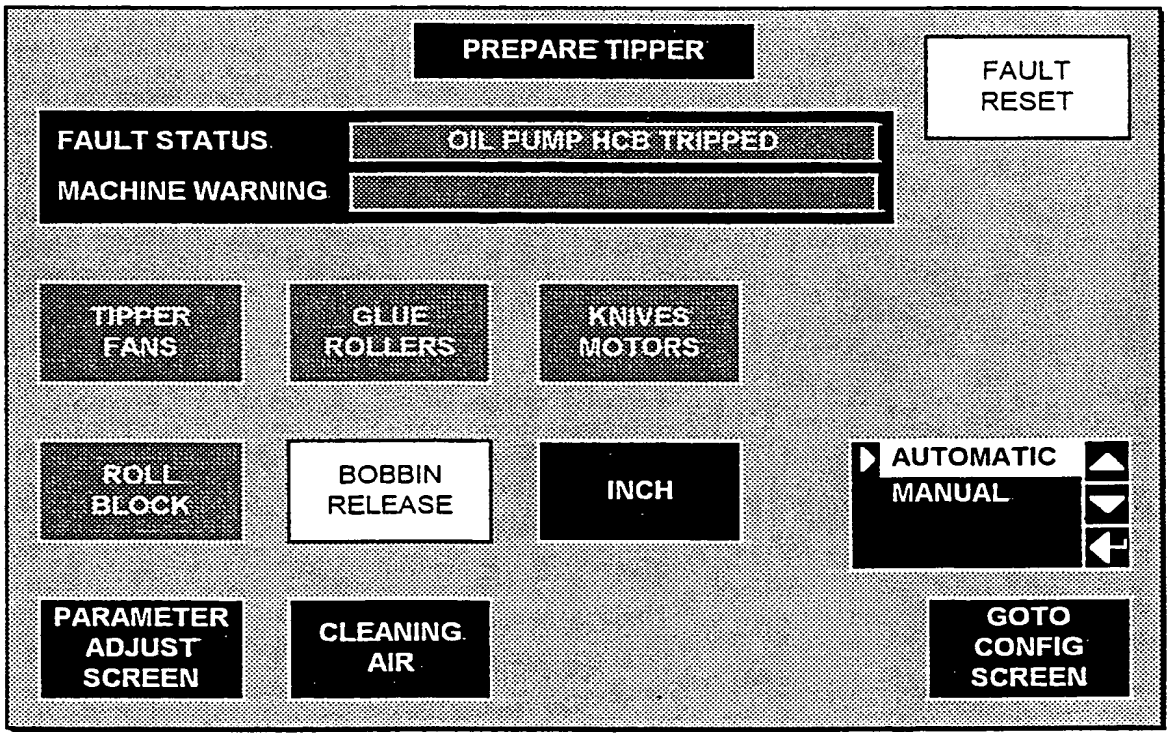

PREPARE TIPPER
FAULT RESET
FAULT STATUS
OIL PUMP HCB TRIPPED
MACHINE WARNING
TIPPER FANS
GLUE ROLLERS
KNIVES MOTORS
ROLL BLOCK
BOBBIN RELEASE
INCH
AUTOMATIC
MANUAL
PARAMETER ADJUST SCREEN
CLEANING AIR
GOTO CONFIG SCREEN

FIG. 36

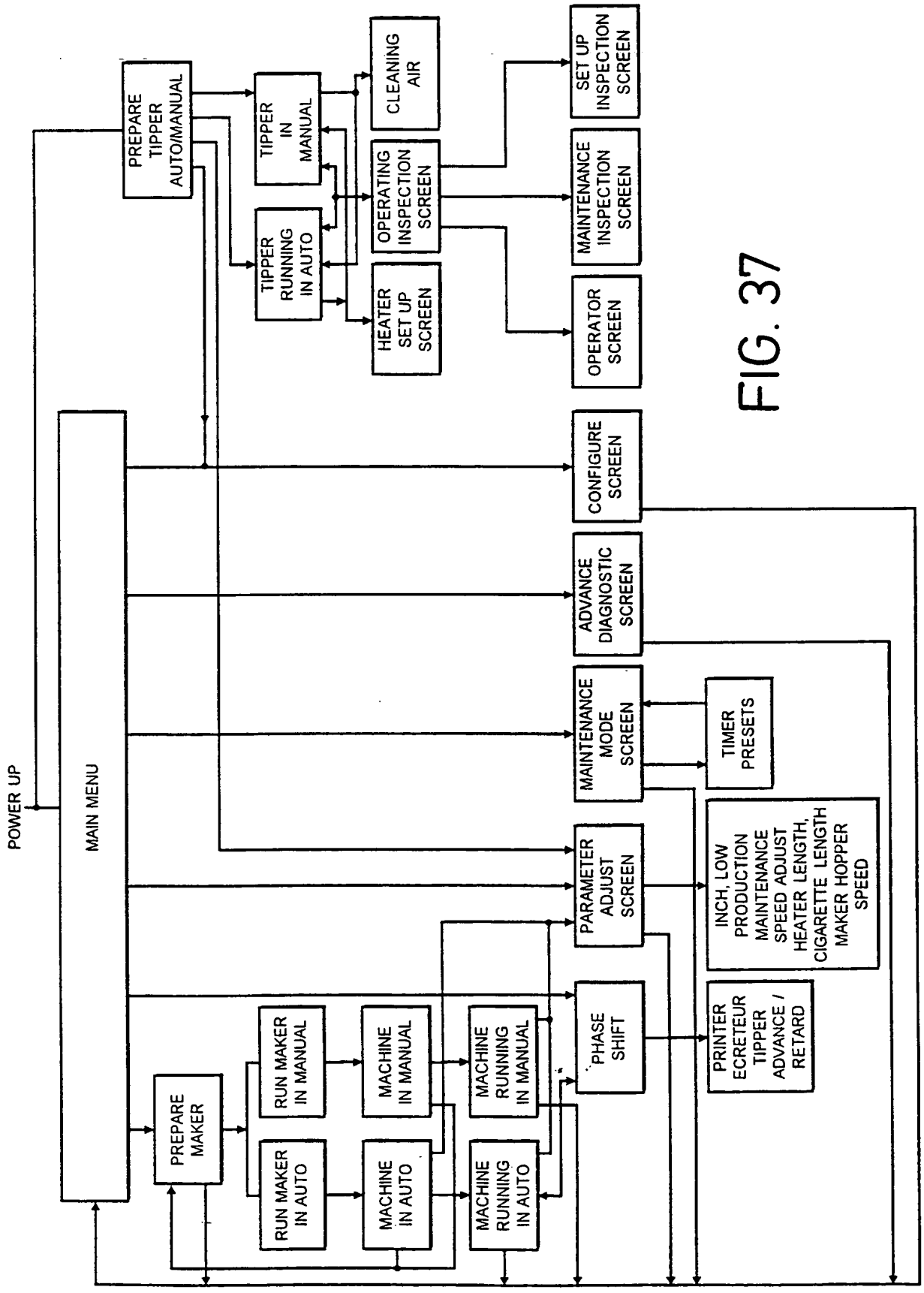

POWER UP
MAIN MENU
PREPARE TIPPER AUTO/MANUAL
TIPPER IN MANUAL
TIPPER RUNNING IN AUTO
CLEANING AIR
OPERATING INSPECTION SCREEN
HEATER SET UP SCREEN
SET UP INSPECTION SCREEN
MAINTENANCE INSPECTION SCREEN
OPERATOR SCREEN
CONFIGURE SCREEN
ADVANCE DIAGNOSTIC SCREEN
MAINTENANCE MODE SCREEN
TIMER PRESETS
PARAMETER ADJUST SCREEN
INCH, LOW PRODUCTION MAINTENANCE SPEED ADJUST HEATER LENGTH, CIGARETTE LENGTH MAKER HOPPER SPEED
PHASE SHIFT
PRINTER ECRETEUR TIPPER ADVANCE / RETARD
PREPARE MAKER
RUN MAKER IN MANUAL
RUN MAKER IN AUTO
MACHINE IN MANUAL
MACHINE IN AUTO
MACHINE RUNNING IN MANUAL
MACHINE RUNNING IN AUTO

FIG. 37

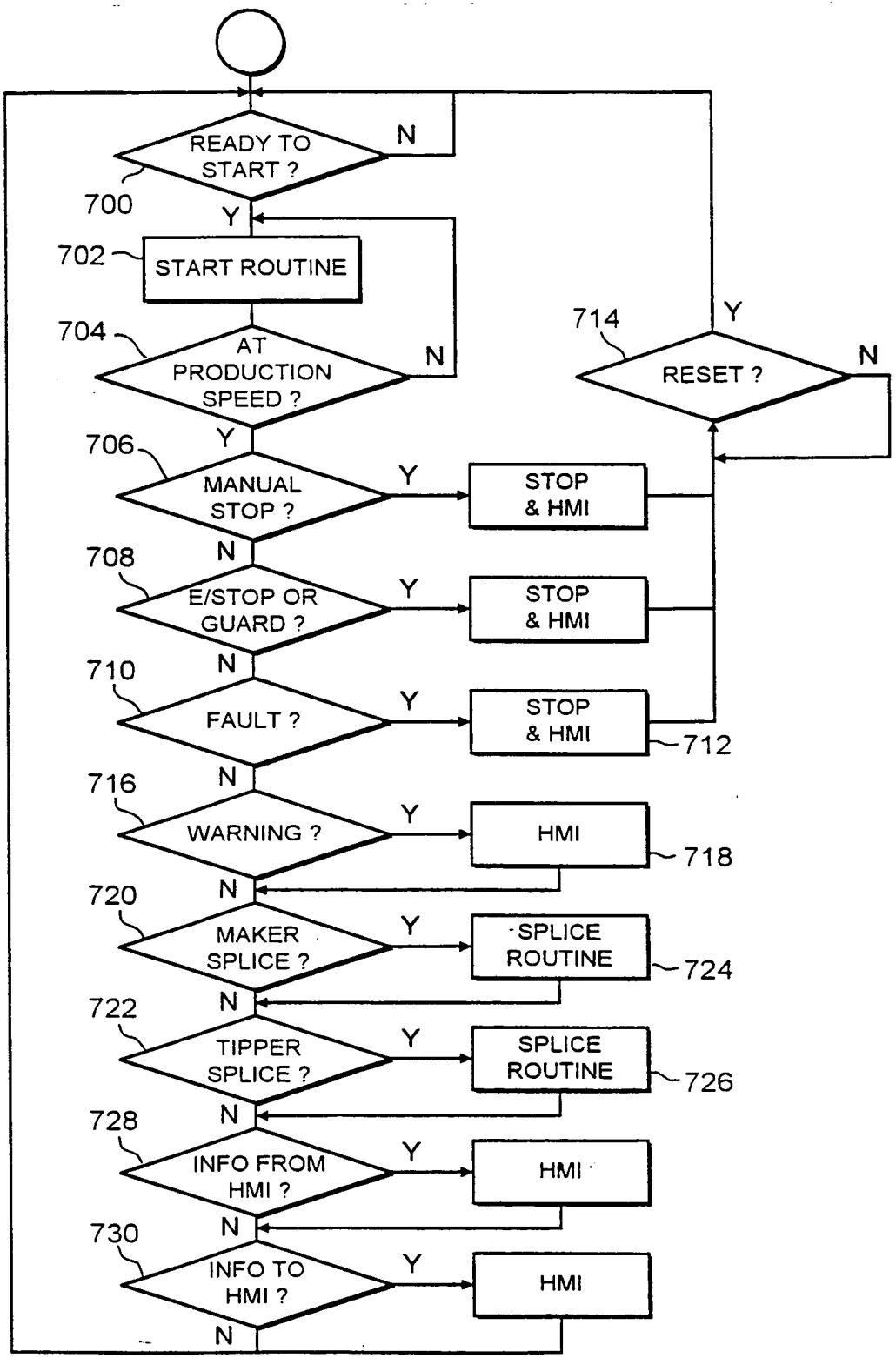

READY TO START ?
700
N
Y
702
START ROUTINE
704
AT PRODUCTION SPEED ?
N
Y
706
MANUAL STOP ?
Y
STOP & HMI
N
708
E/STOP OR GUARD ?
Y
STOP & HMI
N
710
FAULT ?
Y
STOP & HMI
712
N
716
WARNING ?
Y
HMI
718
N
720
MAKER SPLICE ?
Y
SPLICE ROUTINE
724
N
722
TIPPER SPLICE ?
Y
SPLICE ROUTINE
726
N
728
INFO FROM HMI ?
Y
HMI
N
730
INFO TO HMI ?
Y
HMI
N
714
RESET ?
Y
N

FIG. 38

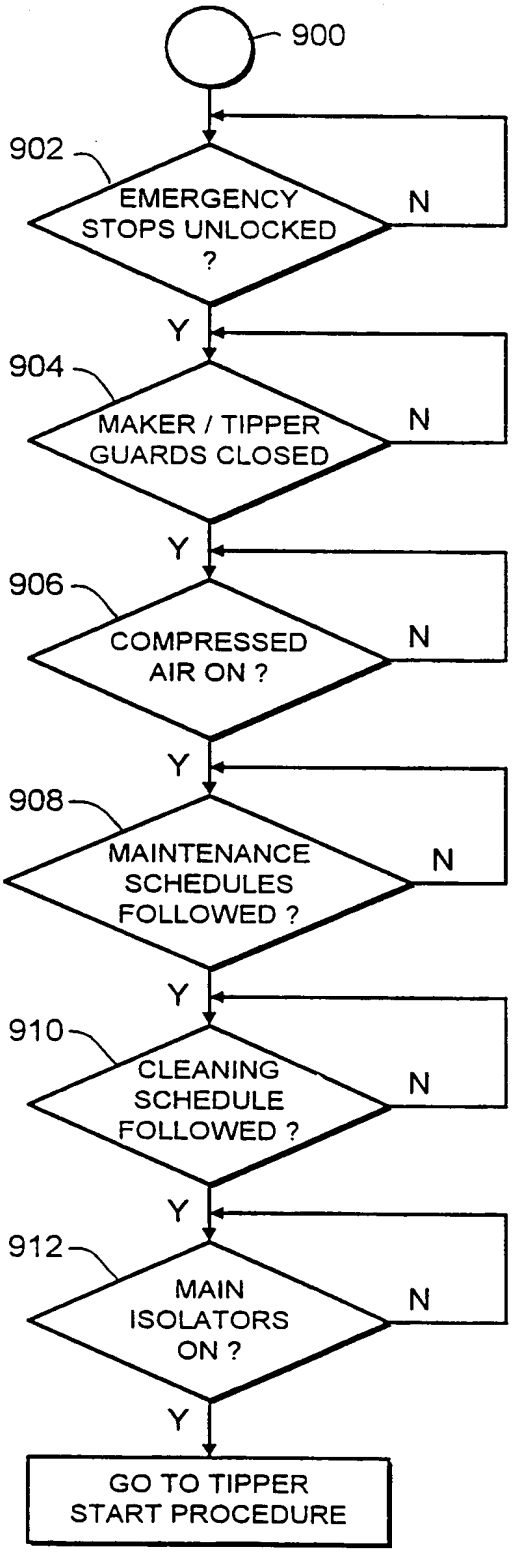

900
902
EMERGENCY STOPS UNLOCKED ?
N
Y
904
MAKER / TIPPER GUARDS CLOSED
N
Y
906
COMPRESSED AIR ON ?
N
Y
908
MAINTENANCE SCHEDULES FOLLOWED ?
N
Y
910
CLEANING SCHEDULE FOLLOWED ?
N
Y
912
MAIN ISOLATORS ON ?
N
Y
GO TO TIPPER START PROCEDURE

FIG. 39

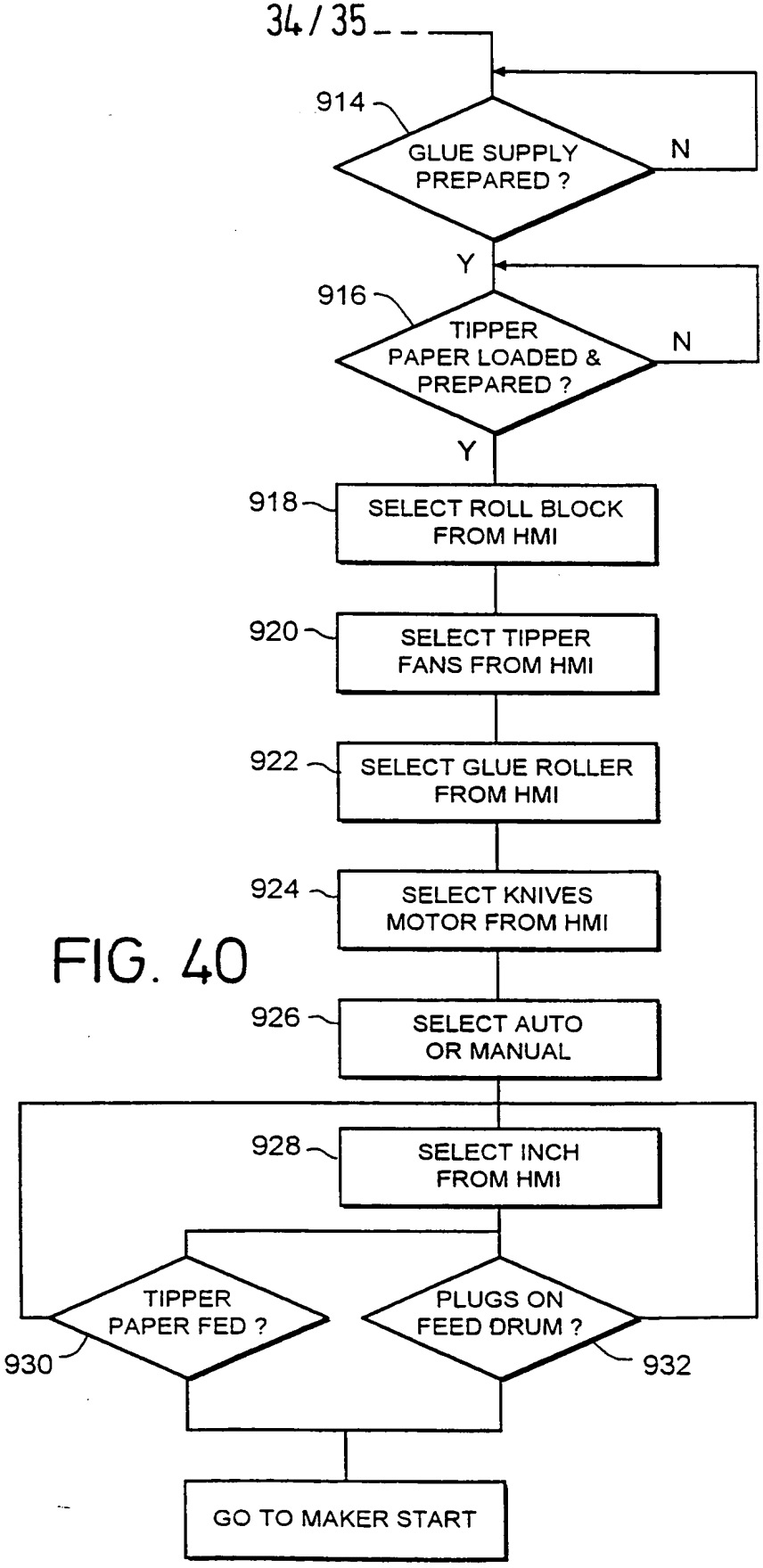

914
GLUE SUPPLY PREPARED ?
N
Y
916
TIPPER PAPER LOADED & PREPARED ?
N
Y
918
SELECT ROLL BLOCK FROM HMI
920
SELECT TIPPER FANS FROM HMI
922
SELECT GLUE ROLLER FROM HMI
924
SELECT KNIVES MOTOR FROM HMI
926
SELECT AUTO OR MANUAL
928
SELECT INCH FROM HMI
TIPPER PAPER FED ?
930
PLUGS ON FEED DRUM ?
932
GO TO MAKER START

FIG. 40

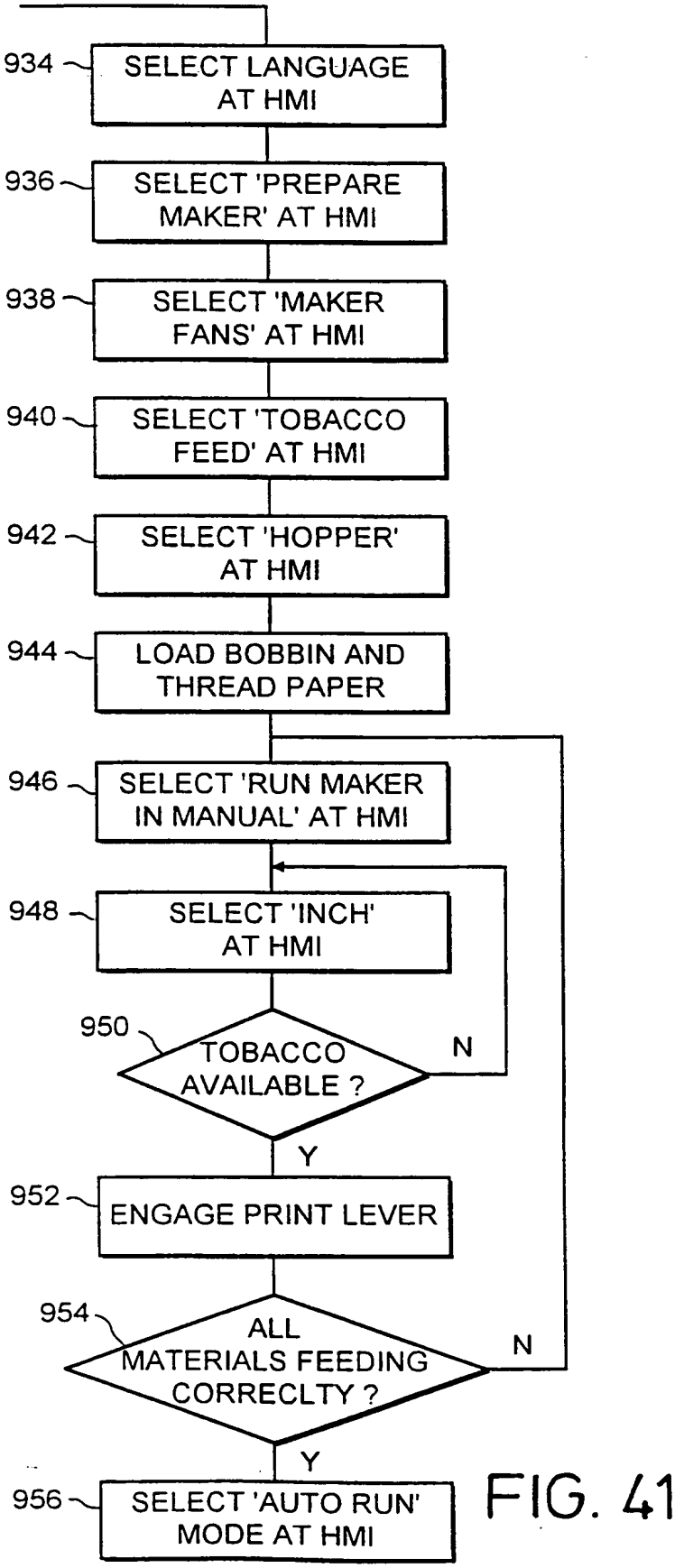

934
SELECT LANGUAGE AT HMI
936
SELECT 'PREPARE MAKER' AT HMI
938
SELECT 'MAKER FANS' AT HMI
940
SELECT 'TOBACCO FEED' AT HMI
942
SELECT 'HOPPER' AT HMI
944
LOAD BOBBIN AND THREAD PAPER
946
SELECT 'RUN MAKER IN MANUAL' AT HMI
948
SELECT 'INCH' AT HMI
950
TOBACCO AVAILABLE ?
N
Y
952
ENGAGE PRINT LEVER
954
ALL MATERIALS FEEDING CORRECLTY ?
N
Y
956
SELECT 'AUTO RUN' MODE AT HMI

FIG. 41

PATENT COOPERATION TREATY

7 DEC

From the INTERNATIONAL SEARCHING AUTHORITY

PCT

NOTIFICATION OF TRANSMITTAL OF THE INTERNATIONAL SEARCH REPORT OR THE DECLARATION

(PCT Rule 44.1)

2 mths

3.2.00.

To:
REDDIE & GROSE
Attn. LLOYD, P.
16, Theobalds Road
London WC1X 8PL
UNITED KINGDOM

PADL

Applicant's or agent's file reference PADL/38884	**FOR FURTHER ACTION** See paragraphs 1 and 4 below
International application No. PCT/GB 99/ 02863	International filing date *(day/month/year)* 01/09/1999
Applicant PHILIP MORRIS PRODUCTS INC. et al.	

Date of mailing *(day/month/year)* 03/12/1999

1. [X] The applicant is hereby notified that the International Search Report has been established and is transmitted herewith.

Filing of amendments and statement under Article 19:
The applicant is entitled, if he so wishes, to amend the claims of the International Application (see Rule 46):

When? The time limit for filing such amendments is normally 2 months from the date of transmittal of the International Search Report; however, for more details, see the notes on the accompanying sheet.

Where? Directly to the International Bureau of WIPO
34, chemin des Colombettes
1211 Geneva 20, Switzerland
Fascimile No.: (41–22) 740.14.35

For more detailed instructions, see the notes on the accompanying sheet.

2. [ ] The applicant is hereby notified that no International Search Report will be established and that the declaration under Article 17(2)(a) to that effect is transmitted herewith.

3. [ ] **With regard to the protest** against payment of (an) additional fee(s) under Rule 40.2, the applicant is notified that:

[ ] the protest together with the decision thereon has been transmitted to the International Bureau together with the applicant's request to forward the texts of both the protest and the decision thereon to the designated Offices.

[ ] no decision has been made yet on the protest; the applicant will be notified as soon as a decision is made.

4. **Further action(s):** The applicant is reminded of the following:

Shortly after **18 months** from the priority date, the international application will be published by the International Bureau. If the applicant wishes to avoid or postpone publication, a notice of withdrawal of the international application, or of the priority claim, must reach the International Bureau as provided in Rules 90*bis*.1 and 90*bis*.3, respectively, before the completion of the technical preparations for international publication.

Within **19 months** from the priority date, a demand for international preliminary examination must be filed if the applicant wishes to postpone the entry into the national phase until 30 months from the priority date (in some Offices even later).

Within **20 months** from the priority date, the applicant must perform the prescribed acts for entry into the national phase before all designated Offices which have not been elected in the demand or in a later election within 19 months from the priority date or could not be elected because they are not bound by Chapter II.

Name and mailing address of the International Searching Authority	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL–2280 HV Rijswijk Tel. (+31–70) 340–2040, Tx. 31 651 epo nl, Fax: (+31–70) 340–3016	Marcel Van den Heuvel

Form PCT/ISA/220 (July 1998)

NOTES TO FORM PCT/ISA/220

These Notes are intended to give the basic instructions concerning the filing of amendments under article 19. The Notes are based on the requirements of the Patent Cooperation Treaty, the Regulations and the Administrative Instructions under that Treaty. In case of discrepancy between these Notes and those requirements, the latter are applicable. For more detailed information, see also the PCT Applicant's Guide, a publication of WIPO.

In these Notes, "Article", "Rule", and "Section" refer to the provisions of the PCT, the PCT Regulations and the PCT Administrative Instructions respectively.

INSTRUCTIONS CONCERNING AMENDMENTS UNDER ARTICLE 19

The applicant has, after having received the international search report, one opportunity to amend the claims of the international application. It should however be emphasized that, since all parts of the international application (claims, description and drawings) may be amended during the international preliminary examination procedure, there is usually no need to file amendments of the claims under Article 19 except where, e.g. the applicant wants the latter to be published for the purposes of provisional protection or has another reason for amending the claims before international pbulication. Furthermore, it should be emphasized that provisional protection is available in some States only.

What parts of the international application may be amended?

Under Article 19, only the claims may be amended.

During the international phase, the claims may also be amended (or further amended) under Article 34 before the International Preliminary Examining Authority. The description and drawings may only be amended under Article 34 before the International Examining Authority.

Upon entry into the national phase, all parts of the international application may be amended under Article 28 or, where applicable, Article 41.

When? Within 2 months from the date of transmittal of the international search report or 16 months from the priority date, whichever time limit expires later. It should be noted, however, that the amendments will be considered as having been received on time if they are received by the International Bureau after the expiration of the applicable time limit but before the completion of the technical preparations for international publication (Rule 46.1).

Where not to file the amendments?

The amendments may only be filed with the International Bureau and not with the receiving Office or the International Searching Authority (Rule 46.2).

Where a demand for international preliminary examination has been/is filed, see below.

How? Either by cancelling one or more entire claims, by adding one or more new claims or by amending the text of one or more of the claims as filed.

A replacement sheet must be submitted for each sheet of the claims which, on account of an amendment or amendments, differs from the sheet originally filed.

All the claims appearing on a replacement sheet must be numbered in Arabic numerals. Where a claim is cancelled, no renumbering of the other claims is required. In all cases where claims are renumbered, they must be renumbered consecutively (Administrative Instructions, Section 205(b)).

The amendments must be made in the language in which the international application is to be published.

What documents must/may accompany the amendments?

Letter (Section 205(b)):

The amendments must be submitted with a letter.

The letter will not be published with the international application and the amended claims. It should not be confused with the "Statement under Article 19(1)" (see below, under "Statement under Article 19(1)").

The letter must be in English or French, at the choice of the applicant. However, if the language of the international application is English, the letter must be in English; if the language of the international application is French, the letter must be in French.

The letter must indicate the differences between the claims as filed and the claims as amended. It must, in particular, indicate, in connection with each claim appearing in the international application (it being understood that identical indications concerning several claims may be grouped),whether

(i) the claim is unchanged;

(ii) the claim is cancelled;

(iii) the claim is new;

(iv) the claim replaces one or more claims as filed;

(v) the claim is the result of the division of a claim as filed.

The following examples illustrate the manner in which amendments must be explained in the accompanying letter:

1. [Where originally there were 48 claims and after amendment of some claims there are 51]:
"Claims 1 to 29, 31, 32, 34, 35, 37 to 48 replaced by amended claims bearing the same numbers; claims 30, 33 and 36 unchanged; new claims 49 to 51 added."

2. [Where originally there were 15 claims and after amendment of all claims there are 11]:
"Claims 1 to 15 replaced by amended claims 1 to 11."

3. [Where originally there were 14 claims and the amendments consist in cancelling some claims and in adding new claims]:
"Claims 1 to 6 and 14 unchanged; claims 7 to 13 cancelled; new claims 15, 16 and 17 added." or
"Claims 7 to 13 cancelled; new claims 15, 16 and 17 added; all other claims unchanged."

4. [Where various kinds of amendments are made]:
"Claims 1-10 unchanged; claims 11 to 13, 18 and 19 cancelled; claims 14, 15 and 16 replaced by amended claim 14; claim 17 subdivided into amended claims 15, 16 and 17; new claims 20 and 21 added."

"Statement under article 19(1)" (Rule 46.4)

The amendments may be accompanied by a statement explaining the amendments and indicating any impact that such amendments might have on the description and the drawings (which cannot be amended under Article 19(1)).

The statement will be published with the international application and the amended claims.

It must be in the language in which the international appplication is to be published.

It must be brief, not exceeding 500 words if in English or if translated into English.

It should not be confused with and does not replace the letter indicating the differences between the claims as filed and as amended. It must be filed on a separate sheet and must be identified as such by a heading, preferably by using the words "Statement under Article 19(1)."

It may not contain any disparaging comments on the international search report or the relevance of citations contained in that report. Reference to citations, relevant to a given claim, contained in the international search report may be made only in connection with an amendment of that claim.

Consequence if a demand for international preliminary examination has already been filed

If, at the time of filing any amendments under Article 19, a demand for international preliminary examination has already been submitted, the applicant must preferably, at the same time of filing the amendments with the International Bureau, also file a copy of such amendments with the International Preliminary Examining Authority (see Rule 62.2(a), first sentence).

Consequence with regard to translation of the international application for entry into the national phase

The applicant's attention is drawn to the fact that, where upon entry into the national phase, a translation of the claims as amended under Article 19 may have to be furnished to the designated/elected Offices, instead of, or in addition to, the translation of the claims as filed.

For further details on the requirements of each designated/elected Office, see Volume II of the PCT Applicant's Guide.

PATENT COOPERATION TREATY

PCT

INTERNATIONAL SEARCH REPORT

(PCT Article 18 and Rules 43 and 44)

Applicant's or agent's file reference	**FOR FURTHER ACTION** see Notification of Transmittal of International Search Report (Form PCT/ISA/220) as well as, where applicable, item 5 below.	
PADL/38884		
International application No.	International filing date *(day/month/year)*	(Earliest) Priority Date *(day/month/year)*
PCT/GB 99/ 02863	01/09/1999	18/09/1998
Applicant		
PHILIP MORRIS PRODUCTS INC. et al.		

This International Search Report has been prepared by this International Searching Authority and is transmitted to the applicant according to Article 18. A copy is being transmitted to the International Bureau.

This International Search Report consists of a total of 3 sheets.

[X] It is also accompanied by a copy of each prior art document cited in this report.

1. **Basis of the report**

   a. With regard to the **language,** the international search was carried out on the basis of the international application in the language in which it was filed, unless otherwise indicated under this item.

   [ ] the international search was carried out on the basis of a translation of the international application furnished to this Authority (Rule 23.1(b)).

   b. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international search was carried out on the basis of the sequence listing :

   [ ] contained in the international application in written form.

   [ ] filed together with the international application in computer readable form.

   [ ] furnished subsequently to this Authority in written form.

   [ ] furnished subsequently to this Authority in computer readble form.

   [ ] the statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.

   [ ] the statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished

2. [ ] **Certain claims were found unsearchable** (See Box I).

3. [ ] **Unity of invention is lacking** (see Box II).

4. With regard to the **title,**

   [X] the text is approved as submitted by the applicant.

   [ ] the text has been established by this Authority to read as follows:

5. With regard to the **abstract,**

   [X] the text is approved as submitted by the applicant.

   [ ] the text has been established, according to Rule 38.2(b), by this Authority as it appears in Box III. The applicant may, within one month from the date of mailing of this international search report, submit comments to this Authority.

6. The figure of the **drawings** to be published with the abstract is Figure No. 31

   [X] as suggested by the applicant.

   [ ] because the applicant failed to suggest a figure.

   [ ] because this figure better characterizes the invention.

   [ ] None of the figures.

INTERNATIONAL SEARCH REPORT

International Application No
PCT/GB 99/02863

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 A24C5/00 A24C5/31

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 A24C A24D G07C

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 4 599 699 A (STEWART-COX) 8 July 1986 (1986-07-08) the whole document	1,19,35, 47,48
A	US 4 463 766 A (ARTHUR) 7 August 1984 (1984-08-07) the whole document	1,2,5,6, 8,10,35, 43,45,47
A	US 3 793 512 A (LORENZEN) 19 February 1974 (1974-02-19) the whole document	1,19,35, 47,48
A	US 5 284 164 A (ANDREWS) 8 February 1994 (1994-02-08) the whole document	1

-/--

[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

° Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
29 November 1999	03/12/1999

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL – 2280 HV Rijswijk Tel. (+31–70) 340–2040, Tx. 31 651 epo nl, Fax: (+31–70) 340–3016	Riegel, R

Form PCT/ISA/210 (second sheet) (July 1992)

INTERNATIONAL SEARCH REPORT

International Application No
PCT/GB 99/02863

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication,where appropriate, of the relevant passages	Relevant to claim No.
A	US 4 280 187 A (REULAND) 21 July 1981 (1981-07-21)	
A	WO 96 15688 A (LORILLARD TOBACCO COMPANY) 30 May 1996 (1996-05-30)	

Form PCT/ISA/210 (continuation of second sheet) (July 1992)

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No
PCT/GB 99/02863

Patent document cited in search report	Publication date	Patent family member(s)		Publication date
US 4599699 A	08-07-1986	AU	563537 B	16-07-1987
		AU	1547583 A	13-12-1984
		CA	1224690 A	28-07-1987
		DE	3319248 A	01-12-1983
		GB	2122399 A,B	11-01-1984
		IT	1166509 B	06-05-1987
US 4463766 A	07-08-1984	EP	0011510 A	28-05-1980
		WO	8001115 A	29-05-1980
		GB	2059245 A,B	23-04-1981
		JP	55500888 T	06-11-1980
		JP	63039226 B	04-08-1988
US 3793512 A	19-02-1974	DE	2013078 A	30-09-1971
		FR	2084648 A	17-12-1971
		GB	1352941 A	15-05-1974
		SE	371089 B	11-11-1974
US 5284164 A	08-02-1994	DE	4237246 A	13-05-1993
		GB	2261153 A,B	12-05-1993
		IT	1258252 B	22-02-1996
US 4280187 A	21-07-1981	DE	2842461 A	10-04-1980
		FR	2437170 A	25-04-1980
		GB	2031263 A,B	23-04-1980
		IT	1123747 B	30-04-1986
		JP	1414061 C	10-12-1987
		JP	55048376 A	07-04-1980
		JP	62019829 B	01-05-1987
WO 9615688 A	30-05-1996	US	5582192 A	10-12-1996
		AT	184455 T	15-10-1999
		DE	69512267 D	21-10-1999
		EP	0793425 A	10-09-1997

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PATENT COOPERATION TREATY

PCT

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference	FOR FURTHER ACTION	See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)

International application No.	International filing date *(day/month/year)*	Priority date *(day/month/year)*
PCT/GB99/02863	01/09/1999	18/09/1998
International Patent Classification (IPC) or national classification and IPC A24C5/00		
Applicant PHILIP MORRIS PRODUCTS INC. et al.		

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.

2. This REPORT consists of a total of 5 sheets, including this cover sheet.

   ☒ This report is also accompanied by ANNEXES, i.e. sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

   These annexes consist of a total of 22 sheets.

3. This report contains indications relating to the following items:

I	☒	Basis of the report
II	☐	Priority
III	☐	Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
IV	☐	Lack of unity of invention
V	☒	Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations suporting such statement
VI	☐	Certain documents cited
VII	☒	Certain defects in the international application
VIII	☒	Certain observations on the international application

Date of submission of the demand	Date of completion of this report
20/01/2000	04.01.2001
Name and mailing address of the international preliminary examining authority: European Patent Office D-80298 Munich Tel. +49 89 2399 - 0 Tx: 523656 epmu d Fax: +49 89 2399 - 4465	Authorized officer Werner, D Telephone No. +49 89 2399 2076

Form PCT/IPEA/409 (cover sheet) (January 1994)

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No. PCT/GB99/02863

I. Basis of the report

1. This report has been drawn on the basis of *(substitute sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to the report since they do not contain amendments (Rules 70.16 and 70.17).)*:
Description, pages:

1-32	as originally filed			
33-46	as received on	28/10/1999	with letter of	01/10/1999

Claims, No.:

1-48	as received on	14/11/2000	with letter of	10/11/2000

Drawings, sheets:

1/35-35/35	as originally filed

2. With regard to the **language**, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.

   These elements were available or furnished to this Authority in the following language: , which is:

   - ☐ the language of a translation furnished for the purposes of the international search (under Rule 23.1(b)).
   - ☐ the language of publication of the international application (under Rule 48.3(b)).
   - ☐ the language of a translation furnished for the purposes of international preliminary examination (under Rule 55.2 and/or 55.3).

3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

   - ☐ contained in the international application in written form.
   - ☐ filed together with the international application in computer readable form.
   - ☐ furnished subsequently to this Authority in written form.
   - ☐ furnished subsequently to this Authority in computer readable form.
   - ☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.
   - ☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

4. The amendments have resulted in the cancellation of:

- ☐ the description, pages:
- ☐ the claims, Nos.:
- ☐ the drawings, sheets:

5. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed (Rule 70.2(c)):

   (Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report.)

6. Additional observations, if necessary:

V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Yes:	Claims	1-48
	No:	Claims	
Inventive step (IS)	Yes:	Claims	1-48
	No:	Claims	
Industrial applicability (IA)	Yes:	Claims	1-48
	No:	Claims	

2. Citations and explanations
   see separate sheet

VII. Certain defects in the international application

The following defects in the form or contents of the international application have been noted:
see separate sheet

VIII. Certain observations on the international application

The following observations on the clarity of the claims, description, and drawings or on the question whether the claims are fully supported by the description, are made:
see separate sheet

SECTION V ----------

The present application seems to satisfy the criterion set forth in Article 33(2) respectively Article 33(3) PCT because the subject-matter of Claims 1 - 48 seems to be new respectively inventive in respect of prior art as defined in the regulations (Rule 64(1)-(3) respectively Rule 65(1)(2) PCT).

As next prior art cited in the application is regarded US-A-3793512 which discloses a method and apparatus for monitoring the operation of tobacco processing machines. There is no suggestion of any automatic adjustment of process parameters as a result of the detection of an out of process condition. The description of this document states that monitored values give readings which can be evaluated by persons or apparatus at any desired distance from the monitored process units, but there is any hint of an automatic amendment of the process parameters und thus no suggestion of automatic variation in any of the process parameters. In US-A-4599699 the system does no more than monitor manufacturing machinery and display messages relating to process fault or deterioration conditions in order to enable the operator to make the necessary adjustments of process parameters in time.

SECTION VII ----------

1. Contrary to the requirements of Rule 5.1(a)(ii) PCT, the relevant background art disclosed in the documents US-A-3793512 and US-A-4599699 is not mentioned in the description, nor is this document identified therein.

2. The features of the claims are not provided with reference signs placed in parentheses (Rule 6.2(b) PCT).

3. The independent claims 1, 19, 35, 47 and 48 are not in the two-part form in accordance with Rule 6.3(b) PCT, which in the present case would be appropriate, with those features known in combination from the prior art (see US-A-3793512) being placed in a preamble (Rule 6.3(b)(i) PCT) and with the remaining features being included in a characterising part (Rule 6.3(b)(ii) PCT).

SECTION VIII----------

Although claims 1, 19, 47 and 48 have been drafted as separate independent claims, they relate effectively to the same subject-matter and to differ from each other only with regard to the definition of the subject-matter for which protection is sought ..and/or.. in respect of the terminology used for the features of that subject-matter. The aforementioned claims therefore lack conciseness. Moreover, lack of clarity of the claims as a whole arises, since the plurality of independent claims makes it difficult, if not impossible, to determine the matter for which protection is sought, and places an undue burden on others seeking to establish the extent of the protection.

Hence, the above mentioned claims do not meet the requirements of Article 6 PCT.

Electrical Reference	Motor Description	Motor Function
Tipper main drive motor (TMDM)	Position Synchronised to Cut off motor	Drives complete tipper gear train
M3	Bobbin Swivel	Swivels the bobbin plate
M4	Glue Stirrer	Provides drive for glue rollers
M5	Glue Pump	Glue feed
M7*1	Fan	Provides Suction for tipping drum
M9*1	Vacuum Pump	Drives knife 1 (filter)
M9*2	Knife 2	Drives knife 2 (tobacco rod)

Table 2: Tipper motors

It should be appreciated that although the system has been described in terms of servo motors, non-servo motors could be used as some degree of control can still be achieved using a conventional variable speed motor with a speed control signal. Alternatively, motors using embedded intelligence may be used to provide synchronisation.

Referring now to figure 29 the positioning of the motors referred to in Table 2 can be appreciated. The main drive motor can be a synchronous servo motor. The other motors on the tipper are standard fixed speed motors. Figures 27 and 28 show the equivalent situation for the rod maker although some of the motors are omitted for clarity.

A preferred embodiment of the control system comprises the following main elements:

1. The machine controller;
2. The motion controller and servo motors;
3. The fieldbus connecting sensors, pneumatic valves and some motor drives to the machine controller;

4. The HMI; and
5. Inspection and rejection.

The machine controller comprises two PCS running the Windows NT (TM) operating system and configured such that one is a server and the other a client. Other operating systems such as WIN CE may be used. The PCs communicate via TCP/IP and Ethernet. The controller software controls both the maker and the tipper using standard PLC functions but without a PLC. The PCs communicate with the machine devices via the fieldbus.

The motion controller and servo motors provide synchronised control of servo motors on multiple axes by an advanced motion controller. Each axis is programmable for motor characteristics, speed, position and phase relationships. Synchronisation between motors relies on high speed communications between each axis controller which is independent of the fieldbus.

The fieldbus connects devices and I/o terminals to the machine controller via a single cable. Sensors attach either directly to the fieldbus cable or to connector blocks on the cable. Pneumatic valves may be attached to the fieldbus via their own interface in their valve island block and other motor drives and the motion controllers connect directly to the cable.

The HMI provides an easy to use, graphical interface for the operation, maintenance and configuration of the machine. In a preferred embodiment it uses a touch screen for operator command entry. The HMI provides on screen buttons, sliders, keyboards etc. for input of data and commands to the machine, as well as on-screen messages, gauges, digital displays, graphs, reports etc. to provide information to the operator. It also includes a database for multi-language messages and for historical records.

Inspection and rejection systems are controlled by an independent, dedicated programmable controller which interfaces to the machine controller and HMI for parameter settings and performance display.

The motion control, fieldbus and HMIs aspects of the control system will now be described in greater detail.

Motion Control. It will be appreciated that the synchronised servomotors are all synchronised to the cut off motor M21 which is the master for motion control. Alternatively, synchronisation may be to a virtual axis. The relationship between garniture belt speed and the cut-off motor speed determines the length of the cut tobacco rod. The ecreteur and printer motors are speed and position synchronised with the cut-off motor and the tipper main drive motor is position synchronised with the cut-off motor. The Tape drum motor, the suction chamber motor and the hopper motor are speed synchronised with the cut-off motor.

In conventional making machines, these motors have been fixed by complex arrangements of gear boxes, shafts, drive belts etc. to support the various main functions controlling the product. By using a motion control system, the one main drive motor and associated drive system may be eliminated. Instead, a number of drives axes are used as the optimum solution between a totally mechanical and totally electrical system. It will be appreciated from tables 1 and 2 that the preferred embodiment has 7 axes, 6 in the maker and 1 in the tipper. Of course, other numbers are possible and other motors may be introduced on separate axes. Use of motion control has the obvious advantage of eliminating some costly gearboxes, but also reduces maintenance, reduces build time and reduces noise. This is especially important in the context of increasing production speeds. Furthermore, motion control allows the phase relationship between the various axes to be used as an alternative to mechanical settings to give much more accurate results in much less time. It allows almost infinite tuning of the relationship between the axes. For example, the mechanical relationship of the tipper catching drum to the cigarette maker is greatly simplified. Moreover, the relationships between the various axes can be varied dynamically. Thus in the example given above, the phase relationship of the catcher drum could be varied according to the machine speed to ensure optimum transfer. A further advantage is

the ability to change rod length without changing parts. Usually a change in rod length would signify a change to production of a different brand. This requires a different label to be printed onto each rod. The print label could be changed electronically using ink jet printing techniques and the relative position on the rod as well as the rod length can both be adjust by varying the relationships between the axes under motion control.

The motion control comprises the seven motors identified earlier each with a motor controller mounted on a backplate with a dedicated processor. The control could alternatively be embedded in the motor. The processor is programmed to synchronise and phase control the motors via their individual controllers and information on phase and speed is fed to the motion processor via a dedicated high speed transmission line. As will be explained, the motion controller may also be connected to the field bus so that it can receive control signal such as stop, start, jog etc. and parameter signals such as speed, phase, etc. and can send status signals to the system. The other motors which do not form a part of the motion control system are connected to the fieldbus either via their controllers or via their direct on-line starters.

Fieldbus. The fieldbus consists of a cable routed around the maker and the tipper to form the backbone of the control system. The controllers and the controlled elements connect to this cable. The flow of signals is controlled by a software protocol. The presently preferred protocols are DeviceNet (TM) and Profibus (TM). This protocol controls signal flow between elements connected to the fieldbus to enable specific signal to be routed to and from specific devices. In the DeviceNet protocol, each signal is a packet containing 8 bytes of data. The packet is preceded by a header which contains information about the content of the message and its priority. Other devices on the fieldbus will be programmed to certain message contents and so will accept or not the message depending on the content of the header. The priority content ensures that only one device transmits at a time. In this way the control system may be configured such that a central controller, typically a PLC or a

PC may control all functions or may be configured such that no central controller exists and intelligent devices communicate with other intelligent devices using peer to peer communications; these devices then perform the control functions related to their own applications.

The devices connected to the fieldbus may be similar to conventional devices with the addition of a processor whose function is to code information for transmission and to decode message the device needs to receive. Thus, for example, a switch would need to transmit information as to whether it is operated or not and possibly diagnostic information such as whether its operating surface is dirty, whether it is overheating, is receiving too much vibration etc. On the other hand, a motor could transmit information such as speed, torque, direction of rotation, power temperature etc. The motor may also receive information such as start, stop, jog, change speed or direction etc. Devices that do not have the necessary processor embedded may still be connected to the fieldbus but will require an interface which will handle coding and decoding. Of course in that case, the device cannot produce diagnostic information.

Figure 30 shows an overview of a first embodiment of the control system. A field bus 500 connects six main system blocks: the maker 502, the maker cabinet 504, the tipper 506, the tipper cabinet 508, the inspection unit 510 and the control system 512. The maker block includes the maker HMI 514, a number of blocks of sensors, here shown as sensor blocks 516, 518 and 520, and a block of pneumatic valves 522. Each of the sensor blocks, the valve blocks and the HMI are connected to the fieldbus 500. The maker cabinet 504 has a number of variable speed drives and a maker machine controller each attached to the fieldbus. In the figure, variable speed drives 524-530 are shown for the picker/winnower, large and small fans and tobacco return. In the tipper, the tipper HMI 532 is connected directly to the fieldbus as are drives block sensors 534, glue area sensors 536, pneumatic valve clutches 538 and pneumatic auto cleaning valves 540. In the tipper cabinet, the tipper machine controller 542 is connected to the fieldbus 500. In the inspection unit, a

DeviceNet scanner 544 is connected to the fieldbus. Connected to the Scanner 544, which acts as an interface, is an inspection and rejection controller 546.

A DeviceNet manager 548 is also connected to the fieldbus. Of course, this manager is chosen according to the fieldbus protocol being used. Finally a central controller 550 is also connected to the fieldbus. This central controller 550 has overall control over all machine functions over the fieldbus. The central controller 550 has VGA, keyboard and mouse inputs 551, which are also attached to a further PC 552 for programming input and to a data capture device 554 which is connected to thee DeviceNet manager 548 via a local Ethernet 556.

The synchronous motor motion controller 557 is connected to the central controller 550 via a remote I/O link 558. It will be appreciated that the motion controller is not connected to the fieldbus. Thus, for example, operating parameters input via the HMIs, which themselves may be accessed remotely are received first by the central controller which can send them to the motion controller if appropriate. Control of speed and phase of the synchronised motors is therefore separate from the HMI functions.

Figure 31 illustrates an alternative control arrangement. In this figure the two HMIs, shown as operator control touch screens 560, 562 are connected by a graphics cable link to the central machine controller 564 and are kept remote from the fieldbus or control network 566. Although one of the HMIs 560 is shown dissociated from the maker cabinet, there is still one HMI for the maker and one for the tipper. The machine controller is connected to management supervisory systems 568 and to the factory network 570 via an Ethernet link. In the maker and tipper cabinets, the valves and various I/O devices are all connected to the control network before. However, in addition, the motion controller 572 is also connected to the control network. It will be appreciated that the HMIs are still separated from the motion control by the overall machine controller 564. In figure 31, a representative selection of maker functions are shown connected to the control network. This is not exhaustive.

HMI. Two HMIs are required providing different functions, one for the tipper and one for the rod maker. This gives rise to the need for two PCS. The PCS are configured such that the database and one HMI process reside on the server PC and the other is configured as a client.

The HMI software, in addition to displaying machine control and message functions allows the integration of other PC applications for historical data analysis, performance reports to networked PCS or systems and on line diagnostic and help facilities such as parts catalogues, operator manuals, expert systems and operator training videos.

The HMI uses open technologies to allow maximum connectivity and use of technologies such as the Internet and Object based programming. This may be utilised to connect to other applications within the factory for maintenance tracking and to a central parts supplier for predictive maintenance and parts ordering. Other applications are, of course possible and will occur to those skilled in the art.

A separate HMI is provided on both the tipper and the rod maker although a single HMI could be used. The HMIs are each controlled by a PC which may be connected through a TCP/IP link for example to a remote LAN. This gives rise to the possibility of accessing the controllers of the tipper and the rod maker from a remote location possibly not even in the factory. The HMIs provide the system supervisor with a software interface to the cigarette making machine. The HMI displays comprise a configurable selection of function buttons, which may be displayed on, for example, a touch sensitive display screen. An operator can input a password from a keypad which will give access to one of a hierarchical set of control levels. For example a master password gives complete access to the system whereas a more restricted access may only allow the user access to certain control functions. As an alternative to a keypad, passwords or user identifiers may be stored on swipe cards or other identification devices and the HMI provided with a suitable card reader.

The HMI may be implemented as a PC with a suitable interface to the machine controller.

Figures 32 to 36 show examples of HMI screens which are presented to the operator. Many of the user selectable features are represented as push buttons. These are areas of the scree which perform a function equivalent to a push button when selected by the operator. As can be seen from the shading of the buttons shown in the figures, different types of function may be displayed as different coloured buttons. For example, each of the following functions may be represented by a different colour: change to another screen; stop a function that is presently running; start a non-running function; inching (very slow movement of a component such as a motor; fault reset; and miscellaneous. At any given time, the HMI will only display to the operator a fraction of the available information, or the available controls. Figure 37 shows the relationship between various different screens which could be presented to an operator with the appropriate level of clearance. It will be clear to those skilled in the art that figure 37 only shows a few of the screens which could be displayed.

The screen shown in figure 32 is the main menu. The information is presented on four rows. The first row 420 is for message display. In figure 32 this informs the operator that the machine is stopped having detected a fault in the roll block heater which is outside its preset operating range. The message row would also display the machine speed in cigarettes per minute if the machine was running.

The second row has only a FAULT RESET button 422 by which the operator resets the machine after a fault has been cleared. The third row has a STOP button 424, selection of which causes the machine to come to a controlled stop; and a SUCTION CHAMBER GUARD 426.

The fourth row has, from left to right, the following buttons:

PREPARE MAKER 428
PARAMETER ADJUST SCREEN 430
PHASE SHIFT SCREEN 432

MAINTENANCE MODE SCREEN 434
ADVANCED DIAGNOSTICS SCREEN 436
GO TO CONFIG SCREEN 438

The PREPARE MAKER button 428 selects the prepare maker screen shown in figure 33. The PARAMETER ADJUST SCREEN button 430 selects the parameter adjust screen shown in figure 34. Selecting the PHASE SHIFT SCREEN button 434 takes the operator to a phase shift screen shown in figure 35. Selecting the MAINTENANCE MODE SCREEN button 434 takes the operator to a maintenance mode screen and selection of the ADVANCED DIAGNOSTICS SCREEN and GO TO CONFIG SCREEN buttons 436, 438 takes the operator to advanced diagnostics and go to configuration screens respectively.

Turning to figure 33, the first row of the prepare maker screen is similar to that of the main menu but additionally includes a display of the present heater temperature. On the second row, in addition to the FAULT RESET button are MAKER FANS, TOBACCO FEED, HOPPER and GARNITURE TAPE buttons 440, 442, 444 and 446. Each of these four buttons turns the respective item on or off when selected. The third row of the screen has, in addition to the suction chamber guard button displayed on the main screen, ROD HEATER ON, HEATER DOWN, MANUAL GLUE and SUCTION CHAMBER TENSION buttons, 448,450,452 and 454. The ROD HEATER on button switches on the rod heater and the HEATER DOWN button brings the heater down allowing lap and heater settings to be checked. The MANUAL GLUE button switches the glue supply on and off and the SUCTION CHAMBER TENSION button allows the suction tape tensioner to be switched on and off. When off, the tape can be removed and changed. The SUCTION CHAMBER GUARD button turns the suction chamber guard on and off.

The fourth row of the prepare maker screen has a MAIN MENU button 456 which returns to the main menu, and buttons 458, 460 RUN MAKER IN MANUAL and RUN MAKER IN AUTO which take the operator to manual/automatic running screens (not shown). The RUN MAKER IN MANUAL button will only operate if the software detects that the MAKER FANS button 440 is on, and the RUN MAKER IN AUTO

function will only operate if the MAKER FANS, TOBACCO FEED and HOPPER buttons are in an on position.

The PARAMETER ADJUST screen in shown in figure 34. This allows the operator to adjust certain parameters of the rod maker from the HMI simply by pressing the relevant areas on the screen. The information on the PARAMETER ADJUST screen is divided into five rows. On the first row are buttons INCH SPEED, MAKER HEATER and CIGARETTE LENGTH 462, 464, and 466, for adjusting the inch speed, the temperature of the maker heater and the cigarette length respectively. On the second row are buttons LOW SPEED, HEATER MAKER STOP HIGH LIMIT and MAKER HOPPER SPEED 468, 470 and 472 for setting low running speed (in cigarettes per minute), for automatically stopping the maker heater when the temperature reaches the set level, and for setting the hopper speed. On the third row are buttons 474, 476 PRODUCTION SPEED and MAKER HEATER STOP LOWER LIMIT for setting production speed and the lower limit of the maker heater. The sole button 478 on the fourth row MAINTENANCE SPEED sets the machine speed for running during maintenance operations. On the fifth row, the sole button 480 PREVIOUS SCREEN returns the user to the previous screen.

Figure 35 shows the phase shift screen. This display has four rows of buttons, the first two of which perform self explanatory functions. On the first row are PRINTER ADVANCE, ECRETEUR ADVANCE and TIPPER ADVANCE buttons 482, 484 and 486. On the second row are PRINTER RETARD, ECRETEUR RETARD AND TIPPER RETARD buttons 488, 490 and 492. On the third row is a PHASE ADJUST button 494 which allows the operator to select the amount by which the selected axis from one of the first two rows is adjusted. Typically the adjustments will be in increments of 0.1mm. The fourth row has PREVIOUS SCREEN and STOP buttons 496 and 498.

The screens illustrated are all examples of maker HMI screens. It will be understood that the tipper HMI displays similar screens as appropriate to the tipper functions. The PREPARE TIPPER screen is shown at figure 36.

Figure 38 is a flow chart which explains the major control steps of the controller. The controller, which is separate from

the HMI may typically be a PC using control software applications running under Microsoft Windows NT, or a display panel.

On initialisation, once the controller has established that the machine is ready to start (at 700), the controller performs a start up routine at 702 and then actively monitors the cigarette production speed at 704. The production speed may be input through the HMI with other production data such as tobacco rod length, tobacco density and print position. In practice, most of these variable are fixed for a given brand of cigarettes and the operator can simply enter through the HMI the brand of cigarette to be manufactured. The combined tipper and rod maker described can operate at speeds of up to 8000 cigarettes per minute (cpm).

At any time during production, the operator can stop the machine. At step 706, the controller looks for an indication of a manual stop and if one is detected stops production and causes that information to be sent to the HMI for display. The controller then keeps looking for a reset command which, when received causes the controller to return to the beginning of the control process. At Step 708 the controller monitors the data on the fieldbus for an emergency stop signal which may be received from one of the devices on the fieldbus, for example in the event of an actual, or impending catastrophic failure of a component. At step 710 the controller monitors the data on the fieldbus for an indication of a fault condition. In either steps 712 or 714 the controller will cause production to be halted and look for a reset command in the same manner as with a manual stop.

The smart devices plugged into the fieldbus may be capable of distinguishing between a condition which requires the production line to be halted and a fault which requires fixing when convenient. At step 716, the controller looks for warning signals put on the fieldbus by any of the devices and relays this warning to the HMI, for example to be displayed, printed or otherwise drawn to the operator's attention. At step 718, having failed to find any reason that requires the production to be stopped, and after any warning messages have been sent to the HMI, the controller at steps 720 and 722 looks for information from sensors located at the wrapper paper bobbin and the tipping

paper bobbin to determine whether either of the bobbins need to be changed. If one does, the controller checks to see that a fresh bobbin is present and then, at step 724 or 726, runs the appropriate splice routine which will involve controlling the speed of the bobbin to gradually bring it up to the manufacturing speed while monitoring the condition of the paper reservoir.

At step 728, the controller looks to see whether there is data on the bus from the HMI and, if so, acts on it and communicates that fact to the HMI. At step 730 the controller sends data on the fieldbus to the HMI that does not fall into the categories described above and which might be required, for example operating data such as running speeds, output rates, reservoir levels, temperatures etc.

Figures 39, 40 and 41 are flow charts of the start up process and help to understand how the HMIs and the control PCS interact. When the operator begins the start up routine at step 900, the software first checks at step 902 that all emergency stops on the system are unlocked. Then at step 904, it checks that all guards and covers on the tipper and the maker are closed. At step 906 it checks that the compressed air supply is on and at step 908 and 910 it checks that the appropriate maintenance and cleaning schedules have been followed. Finally at step 912 the main isolators are checked and if on, the software enters the tipper start procedure at which point the operator selects the prepare tipper screen of figure 31. The tipper start procedure commences by checking, at 914 and 916, that the glue supply and tipper paper are in order. If they are, the operator selects from the HMI screen, at steps 918, 920, 922, 924, 926 and 928, the ROLL BLOCK, TIPPER FANS, GLUE ROLLER, KNIVES MOTOR, AUTO/MANUAL and INCH to turn each function on and select between automatic and manual operation. The INCH function will advance the tipper until it is determined, at 930, 932, that the tipper paper feed is in the correct position and the filter plugs are on the feed drum. At that point the software can proceed to the maker start routine illustrated in figure 35. The operator initially selects the display language at the HMI, at 934 and then presses, at 936, the prepare maker screen from the

main display. On the prepare maker screen, the operator then switches on the maker fans, the tobacco feed, and the hopper at steps 938,940 and 944. At 946, the operator loads the bobbin with paper and threads the paper through the printer and then, at 948, selects INCH from the HMI display whereupon the drives are slowly moved round until the software detects that tobacco is available at 950 at which point paper is fed along the garniture and the print lever engaged at 952. When it is found that all materials are feeding correctly, at 954, the operator can select at 956 the RUN MAKER IN AUTO button from the prepare maker screen and the run automatically from the AUTO RUN screen.

The cigarette rod maker and tipper described, and the method of control have a number of advantages over prior art systems. The use of synchronous drive motors eliminates the need for noisy inefficient gearboxes running off a central motor facilitating an increased running speed. Moreover parameters such as print position, and dense end position can be moved as a control operation related to the printer or cam phase. This means that these parameters can be adjusted with reduced production stoppage time. This results in an improvement in quality which can reduce production costs. As well as giving higher operating speeds, the use of synchronous servo motors is much less noisy which contributes to a more benign working environment. In addition the energy requirements are much lower. A further advantage of the system is that by dispensing with a greater part of the mechanical linkages, the mean time between failures is increased. The use of a PC based HMI and smart sensors and other devices also reduces the mean time to repair as diagnostics information is available at the HMI. The HMI can also identify the particular component which requires replacing by use of an on-line catalogue. This in turn can reduce the size of inventory that has to be carried. As the HMI can be connected by a TCP/IP link to an Intranet or LAN, remote diagnostics are possible as well as remote repairs and upgrades. In addition, factory data can be downloaded from a central source to one or a number of machines. This, may include information such as master clock, shift times, brand data etc. Furthermore, the HMI can be

programmed to carry instructional information which can used to inform operators, for example, about aspects of the machine control which they would rarely encounter, or to run interactive training programs, for example on CD-ROM or training videos for new operators.

PATENT COOPERATION TREATY

File with PACL

PACL 18.3.01

PCT

From the
INTERNATIONAL PRELIMINARY EXAMINING AUTHORITY

To:

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GRANDE BRETAGNE

NOTIFICATION OF TRANSMITTAL OF THE INTERNATIONAL PRELIMINARY EXAMINATION REPORT
(PCT Rule 71.1)

Date of mailing *(day/month/year)*	04.01.2001
Applicant's or agent's file reference --- 38884.	**IMPORTANT NOTIFICATION**

International application No.	International filing date *(day/month/year)*	Priority date *(day/month/year)*
PCT/GB99/02863	01/09/1999	18/09/1998

Applicant
PHILIP MORRIS PRODUCTS INC. et al.

1. The applicant is hereby notified that this International Preliminary Examining Authority transmits herewith the international preliminary examination report and its annexes, if any, established on the international application.

2. A copy of the report and its annexes, if any, is being transmitted to the International Bureau for communication to all the elected Offices.

3. Where required by any of the elected Offices, the International Bureau will prepare an English translation of the report (but not of any annexes) and will transmit such translation to those Offices.

4. **REMINDER**

The applicant must enter the national phase before each elected Office by performing certain acts (filing translations and paying national fees) within 30 months from the priority date (or later in some Offices) (Article 39(1)) (see also the reminder sent by the International Bureau with Form PCT/IB/301).

Where a translation of the international application must be furnished to an elected Office, that translation must contain a translation of any annexes to the international preliminary examination report. It is the applicant's responsibility to prepare and furnish such translation directly to each elected Office concerned.

For further details on the applicable time limits and requirements of the elected Offices, see Volume II of the PCT Applicant's Guide.

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Form PCT/IPEA/416 (July 1992)

PATENT COOPERATION TREATY

PCT

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference	FOR FURTHER ACTION	See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)

International application No.	International filing date *(day/month/year)*	Priority date *(day/month/year)*
PCT/GB99/02863	01/09/1999	18/09/1998

International Patent Classification (IPC) or national classification and IPC
A24C5/00

Applicant
PHILIP MORRIS PRODUCTS INC. et al.

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.

2. This REPORT consists of a total of 5 sheets, including this cover sheet.

   ☒ This report is also accompanied by ANNEXES, i.e. sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

   These annexes consist of a total of 22 sheets.

3. This report contains indications relating to the following items:

   - I ☒ Basis of the report
   - II ☐ Priority
   - III ☐ Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
   - IV ☐ Lack of unity of invention
   - V ☒ Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations suporting such statement
   - VI ☐ Certain documents cited
   - VII ☒ Certain defects in the international application
   - VIII ☒ Certain observations on the international application

Date of submission of the demand	Date of completion of this report
20/01/2000	04.01.2001

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INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No. PCT/GB99/02863

I. Basis of the report

1. This report has been drawn on the basis of *(substitute sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to the report since they do not contain amendments (Rules 70.16 and 70.17).)*:
Description, pages:

1-32	as originally filed			
33-46	as received on	28/10/1999	with letter of	01/10/1999

Claims, No.:

1-48	as received on	14/11/2000	with letter of	10/11/2000

Drawings, sheets:

1/35-35/35	as originally filed

2. With regard to the **language**, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.

   These elements were available or furnished to this Authority in the following language: , which is:

   ☐ the language of a translation furnished for the purposes of the international search (under Rule 23.1(b)).
   ☐ the language of publication of the international application (under Rule 48.3(b)).
   ☐ the language of a translation furnished for the purposes of international preliminary examination (under Rule 55.2 and/or 55.3).

3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

   ☐ contained in the international application in written form.
   ☐ filed together with the international application in computer readable form.
   ☐ furnished subsequently to this Authority in written form.
   ☐ furnished subsequently to this Authority in computer readable form.
   ☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.
   ☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

4. The amendments have resulted in the cancellation of:

- ☐ the description, pages:
- ☐ the claims, Nos.:
- ☐ the drawings, sheets:

5. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed (Rule 70.2(c)):

   (Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report.)

6. Additional observations, if necessary:

V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Yes:	Claims	1-48
	No:	Claims	
Inventive step (IS)	Yes:	Claims	1-48
	No:	Claims	
Industrial applicability (IA)	Yes:	Claims	1-48
	No:	Claims	

2. Citations and explanations
   see separate sheet

VII. Certain defects in the international application

The following defects in the form or contents of the international application have been noted:
see separate sheet

VIII. Certain observations on the international application

The following observations on the clarity of the claims, description, and drawings or on the question whether the claims are fully supported by the description, are made:
see separate sheet

SECTION V ----------

The present application seems to satisfy the criterion set forth in Article 33(2) respectively Article 33(3) PCT because the subject-matter of Claims 1 - 48 seems to be new respectively inventive in respect of prior art as defined in the regulations (Rule 64(1)-(3) respectively Rule 65(1)(2) PCT).

As next prior art cited in the application is regarded US-A-3793512 which discloses a method and apparatus for monitoring the operation of tobacco processing machines. There is no suggestion of any automatic adjustment of process parameters as a result of the detection of an out of process condition. The description of this document states that monitored values give readings which can be evaluated by persons or apparatus at any desired distance from the monitored process units, but there is any hint of an automatic amendment of the process parameters und thus no suggestion of automatic variation in any of the process parameters. In US-A-4599699 the system does no more than monitor manufacturing machinery and display messages relating to process fault or deterioration conditions in order to enable the operator to make the necessary adjustments of process parameters in time.

SECTION VII ----------

1. Contrary to the requirements of Rule 5.1(a)(ii) PCT, the relevant background art disclosed in the documents US-A-3793512 and US-A-4599699 is not mentioned in the description, nor is this document identified therein.

2. The features of the claims are not provided with reference signs placed in parentheses (Rule 6.2(b) PCT).

3. The independent claims 1, 19, 35, 47 and 48 are not in the two-part form in accordance with Rule 6.3(b) PCT, which in the present case would be appropriate, with those features known in combination from the prior art (see US-A-3793512) being placed in a preamble (Rule 6.3(b)(i) PCT) and with the remaining features being included in a characterising part (Rule 6.3(b)(ii) PCT).

SECTION VIII----------

Although claims 1, 19, 47 and 48 have been drafted as separate independent claims, they relate effectively to the same subject-matter and to differ from each other only with regard to the definition of the subject-matter for which protection is sought ..and/or.. in respect of the terminology used for the features of that subject-matter. The aforementioned claims therefore lack conciseness. Moreover, lack of clarity of the claims as a whole arises, since the plurality of independent claims makes it difficult, if not impossible, to determine the matter for which protection is sought, and places an undue burden on others seeking to establish the extent of the protection.

Hence, the above mentioned claims do not meet the requirements of Article 6 PCT.

CLAIMS

1. A cigarette manufacturing apparatus comprising:

a tobacco rod maker for making double length tobacco rods;

a tipper for applying filters to tobacco rods to form filter tipped cigarettes;

a transfer apparatus for transferring double length tobacco rods from the rod maker to the tipper;

wherein each of the tipper and the rod maker comprises a plurality of devices for monitoring and a plurality of devices for affecting parameters of the rod maker, the tipper or the cigarettes being manufactured, and wherein one or more of said monitoring devices and said parameter affecting devices both monitors and affects parameters;

a controller for controlling the plurality of devices on the tipper and the rod maker, including varying one or more parameters of the rod maker, the tipper or the cigarettes being manufactured, in response to conditions monitored by one or more of said devices; and

a field bus, the plurality of devices and the controller each being connected to the field bus.

2. Apparatus according to claim 1, further comprising a plurality of synchronous motors controlled by a motion controller.

3. Apparatus according to claim 2, wherein the motion controller is connected to the controller.

4. Apparatus according to claim 2 or 3, wherein the motion controller is connected to the field bus.

5. Apparatus according to claim 2, 3 or 4, wherein the plurality of motors includes a cut-off motor for driving a device for cutting individual tobacco rods, a suction chamber motor for driving a suction belt, a garniture belt drive motor, and a hopper motor for controlling the rate at which tobacco is drawn from a hopper.

6. Apparatus according to claim 5, wherein the rotational speed of the suction chamber motor, the garniture belt drive

motor and the hopper motor are synchronised to the rotational speed of the cut-off motor.

7. Apparatus according to claim 5, wherein the rotational speed of the cut-off motor, the suction chamber motor, the garniture belt drive motor and the hopper motor are synchronised to a virtual axis.

8. Apparatus according to claim 5, 6 or 7 , wherein the plurality of motors further includes an ecreteur motor for driving a dense end cam and a pair of ecreteur discs, a capstan motor, and a printer motor for driving a printer to print onto the cigarette wrapping paper.

9 Apparatus according to claim 8, wherein the ecreteur motor and the printer motor are speed and position synchronised to the cut-off motor or the virtual axis.

10. Apparatus according to claim 5,6 or 7, wherein the plurality of motors further includes a tipper motor for driving a tipper drum train, wherein the tipper motor is synchronised to the position of the cut-off motor or to the virtual axis.

11. Apparatus according to any preceding claim further comprising at least one human-machine interface (HMI) connected to the field bus.

12. Apparatus according to claim 11, wherein the at least one HMI comprises a rod maker HMI and a tipper HMI, each of the rod maker HMI and the tipper HMI being connected to the controller via the fieldbus.

13. Apparatus according to any of claims 1 to 10, comprising at least one human-machine interface (HMI) connected to the controller.

14. Apparatus according to claim 13, wherein the at least one HMI comprises a rod maker HMI and a tipper HMI, each of the rod maker HMI and the tipper maker HMI being connected to the controller.

15. Apparatus according to any of claims 11 to 14, wherein the at least one HMI is connected to a communications network.

16. Apparatus according to any preceding claim, wherein at least one of the plurality of devices is connected to the field bus via an interface.

17. Apparatus according to any of claims 1 to 15, wherein at least one of the devices is a field device.

18. Apparatus according to any of claims 1 to 15, wherein at least of the plurality of devices transmits data including diagnostic data to the controller over the field bus.

19. A cigarette manufacturing apparatus comprising:

a tobacco rod maker for making double length tobacco rods;

a tipper for applying filters to tobacco rods to form filter tipped cigarettes;

a transfer apparatus for transferring double length tobacco rods from the rod maker to the tipper;

wherein each of the tipper and the rod maker comprises a plurality of devices for monitoring and a plurality of devices for affecting parameters of the rod maker, the tipper or the cigarette being manufactured, and wherein one or more of said monitoring devices and said parameter affecting devices both monitors and affects parameters;

a first controller for controlling the plurality of devices on the tipper and the rod maker, including varying parameters of the rod maker, the tipper or the cigarettes being manufactured, in response to conditions monitored by one or more of said devices; and

a second controller for providing tipper, rod maker and cigarette information to an operator and for communicating input data from the user to one or both of the first and second controllers.

20. Apparatus according to claim 19, wherein the second controller includes at least one Human/Machine Interface (HMI) and communicates with the first controller, for communicating tipper, rod maker and cigarette data to an operator and for communicating input data to the first controller.

21. Apparatus according to claim 19, wherein the second controller comprises a tipper controller communicating with a tipper HMI and a rod maker controller communicating with a rod maker HMI.

22. Apparatus according to claim 21, wherein the tipper controller and the rod maker controller each comprises a PC or similar device.

23. Apparatus according to claim 21 or 22, wherein the tipper controller and the rod maker controller each comprise an HMI.

24. Apparatus according to claim 21, 22 or 23, wherein the tipper controller and the rod maker controller are interconnected.

25. Apparatus according to any of claims 19 to 24, wherein the first controller and at least some of the rod maker and tipper devices are connected to a fieldbus.

26. Apparatus according to claim 25, wherein the second controller is connected to the fieldbus.

27. Apparatus according to any of claims 19 to 26, wherein the second controller is connected to an external communications network.

28. Apparatus according to any of claims 19 to 27, further comprising a motion controller controlled by the first controller for synchronising a plurality of motors on one or both of the rod maker and the tipper.

29. Apparatus according to claim 28, wherein the plurality of motors includes a cut-off motor for driving a device for cutting individual tobacco rods and the remainder of the plurality of motors is synchronised to the cut-off motor.

30. Apparatus according to claim 28, wherein the plurality of motors is synchronised to a virtual axis.

31. Apparatus according to claim 26, 27 or 28, wherein the motion controller is connected to the field bus.

32. Apparatus according to any of claims 11 to 15 or 20 to 24, wherein the HMI is configured to display to the operator one of a hierarchical set of display screens.

33. Apparatus according to claim 32, wherein at least one of the set of screens includes rows areas representing buttons for controlling rod maker or tipper functions.

34. Apparatus according to claim 32 or 33, wherein the HMI is configured to display diagnostic information from tipper or rod maker components.

35. A method of controlling the manufacture of cigarettes by an apparatus comprising a tobacco rod maker and tipper interconnected by a rod transfer apparatus, the method comprising the steps of:

providing a field bus and a machine controller connected to the field bus;

connecting a plurality of devices to the field bus for monitoring and a plurality of devices for affecting parameters of the rod maker, the tipper or the cigarettes being manufactured, one or more of said monitoring devices and said parameter affecting devices both monitoring and affecting parameters;

monitoring the field bus from the controller for data from the devices; and

automatically adjusting one or more parameters of the tipper or rod maker in accordance with the information content of the data received.

36 A method according to claim 35, further comprising providing a second controller to interface with the machine controller, wherein the machine controller receives data from and sends data to the second controller.

37. A method according to claim 35 or 36, wherein the machine controller looks for a signal on the field bus indicating a machine stop command input from the second controller and, if the machine stop signal is present, sends a stop signal to the field devices.

38. A method according to claim 35, 36 or 37, wherein the machine controller looks for a signal on the field bus indicating an emergency stop condition or indicating that a protective guard on the rod maker or tipper is not in place and, if the signal is present, sends a stop signal to the field device.

39. A method according to any of claims 35 to 38, wherein the machine controller looks for a signal on the field bus indicating a fault condition at one of the field devices and, if the fault condition signal is present, sends a stop signal to the field device.

40. A method according to any of claims 35 to 37, wherein the machine controller also communicates the stop signal to the second controller together with information identifying the cause of the stop signal.

41. A method according to claim 40, wherein the information sent to the second controller includes diagnostic information and component identification information.

42. A method according to any of claims 35 to 41, wherein the machine controller looks for a signal on the field bus warning of a non-ideal condition at one of the field devices and, if the warning signal is present, sends a warning signal to the second controller.

43. A method according to any of claims 35 to 42, wherein the field of devices include a cut-off motor which controls the cutting of cigarette rods from a continuous length of wrapped tobacco produced by the rod maker and a plurality of further motors synchronised to the cut-off motor.

44. A method according to any of claims 35 to 42, wherein the field devices include a cut-off motor which controls the cutting of cigarette rods from a continuous length of wrapped tobacco produced by the rod maker and a plurality of further motors, the further motors and the cut-off motor being synchronised to a virtual axis.

45. A method according to claim 43 or 44, wherein the synchronised motors include motors synchronised by speed and motors synchronised by position.

46. A method according to any of claims 35 to 45, wherein the machine controller looks for a signal on the field bus indicating that a wrapping paper bobbin or a tipping paper bobbin is nearly exhausted and, if the signal is detected, initiates a routine to splice a fresh paper bobbin onto the present paper bobbin.

47. A cigarette manufacturing apparatus comprising:

a tobacco rod maker for making double length tobacco rods;

a tipper for applying filters to tobacco rods to form filter tipped cigarettes;

a transfer apparatus for transferring double length tobacco rods from the rod maker to the tipper;

a plurality of synchronised motors each for driving a respective operation in the tipper or the rod maker;

wherein each of the tipper and the rod maker further includes a plurality of devices for monitoring and a plurality of devices for affecting parameters of the rod maker, the tipper or the cigarettes being manufactured, and wherein one or more of said monitoring devices and said parameter affecting devices both monitors and affects parameters.

a motion control device for controlling the plurality of synchronised motors;

a system for controlling the plurality of devices on the tipper and the rod maker, including varying one or more parameters of the rod maker, the tipper or the cigarettes to be manufactured, in response to conditions monitored by one or more of said devices, the motion control devices being connected to the system controller; and

a field bus, the plurality of devices and the controller each being connected to the communications network.

48. A cigarette manufacturing apparatus comprising:

a tobacco rod maker for making double length tobacco rods;

a tipper for applying filters to tobacco rods to form filter tipped cigarettes;

a transfer apparatus for transferring double length tobacco rods from the rod maker to the tipper;

wherein each of the tipper and the rod maker comprises a plurality of devices for monitoring and a plurality of devices for affecting parameters of the rod maker, the tipper or the cigarettes being manufactured, and wherein one or more of said monitoring devices and said parameter affecting devices both monitors and affects parameters;

a control network, the plurality of devices being coupled to the control network;

a first controller connected to the control network for controlling the plurality of devices on the tipper and the rod maker, including varying one or more parameters of the rod maker, the tipper or the cigarettes to be manufactured, in response to the conditions monitored by one or more of said devices;

a second controller coupled to the first controller and including at least one HMI for providing tipper, rod maker and cigarette information to an operator and for communicating input data from the user to the first controller.

PATENT COOPERATION TREATY

From the:
INTERNATIONAL PRELIMINARY EXAMINING AUTHORITY

To:
LLOYD, Patrick A.D.
REDDIE & GROSE
16, Theobalds Road
London WC1X 8PL
GRANDE BRETAGNE

PCT

WRITTEN OPINION

(PCT Rule 66)

Date of mailing *(day/month/year)*	29.06.2000
Applicant's or agent's file reference --- 38384	**REPLY DUE** **within 3 month(s)** from the above date of mailing

International application No.	International filing date *(day/month/year)*	Priority date *(day/month/year)*
PCT/GB99/02863	01/09/1999	18/09/1998

International Patent Classification (IPC) or both national classification and IPC
A24C5/00

Applicant
PHILIP MORRIS PRODUCTS INC. et al.

1. This written opinion is the **first** drawn up by this International Preliminary Examining Authority.

2. This opinion contains indications relating to the following items:

I	☒	Basis of the opinion
II	☐	Priority
III	☐	Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
IV	☐	Lack of unity of invention
V	☒	Reasoned statement under Rule 66.2(a)(ii) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
VI	☐	Certain document cited
VII	☒	Certain defects in the international application
VIII	☒	Certain observations on the international application

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3. The applicant is hereby **invited to reply** to this opinion.

When? See the time limit indicated above. The applicant may, before the expiration of that time limit, request this Authority to grant an extension, see Rule 66.2(d).

How? By submitting a written reply, accompanied, where appropriate, by amendments, according to Rule 66.3. For the form and the language of the amendments, see Rules 66.8 and 66.9.

Also: For an additional opportunity to submit amendments, see Rule 66.4.
For the examiner's obligation to consider amendments and/or arguments, see Rule 66.4 bis.
For an informal communication with the examiner, see Rule 66.6.

If no reply is filed, the international preliminary examination report will be established on the basis of this opinion.

4. The final date by which the international preliminary examination report must be established according to Rule 69.2 is: 18/01/2001.

Name and mailing address of the international preliminary examining authority:
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Fax: +49 89 2399 - 4465

Authorized officer / Examiner
Werner, D

Formalities officer (incl. extension of time limits)
Riebel, O
Telephone No. +49 89 2399 2967

I. Basis of the opinion

1. This opinion has been drawn on the basis of (*substitute sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this opinion as "originally filed".*):

Description, pages:

1-32	as originally filed			
33-46	as received on	28/10/1999	with letter of	01/10/1999

Claims, No.:

1-48	as received on	28/10/1999	with letter of	01/10/1999

Drawings, sheets:

1/35-35/35	as originally filed

2. The amendments have resulted in the cancellation of:

- ☐ the description, pages:
- ☐ the claims, Nos.:
- ☐ the drawings, sheets:

3. This opinion has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed (Rule 70.2(c)):

4. Additional observations, if necessary:

V. Reasoned statement under Rule 66.2(a)(ii) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Claims	
Inventive step (IS)	Claims	1,2,5,6,8,10,19,35,43,45,47,48
Industrial applicability (IA)	Claims	

2. Citations and explanations

see separate sheet

VII. Certain defects in the international application

The following defects in the form or contents of the international application have been noted:

see separate sheet

VIII. Certain observations on the international application

The following observations on the clarity of the claims, description, and drawings or on the question whether the claims are fully supported by the description, are made:

see separate sheet

SECTION V ----------

1. The present application does not satisfy the criterion set forth in Article 33(3) PCT because the subject-matter of the claims 1, 2, 5, 6, 8, 10, 19, 35, 43, 45, 47 and 48 thereof does not involve an inventive step (Rule 65(1)(2) PCT).

1.1 The next, relevant prior art US-A-4599699, (D1) (see esp. abstract; figures) in combination with the state of the art of US-A-3793512 (D5)(see esp. abstract; figures and ref. description) discloses already a cigarette manufacturing apparatus (claims 1, 19, 48) and a method of controlling the manufacture of cigarettes by an apparatus comprising a tobacco rod maker and tipper interconnected by a rod transfer apparatus (claims 35, 47) of the same kind comprising all features of the independent claims 1, 19, 48 resp. 35 and 47.

Therefore the subject-matter of the aforementioned claims is not inventive and accordingly these claims are not allowable.

1.2 The remaining dependent claims, esp. the claims 2, 5, 6, 8, 10, 43, 45, do not appear to contain a subject-matter that combined with the features of the aforementioned independent claims could lead to an allowable main resp. independent claim because the features of the dependent claims merely relate to details of construction which seem to be obvious to a skilled person working in the same technical field esp. in the light of the known prior art of D1, D2 and US-A-4463766 (D3).

SECTION VII ----------

1. To meet the requirements of Rule 5.1(a)(ii) PCT, the documents D1 - D3 should be identified in the description and the relevant background art disclosed therein should be briefly discussed.

2. To meet the requirements of Rule 6.3(b) PCT the independent claims should be properly cast in the two part form, with those features which in combination are

part of the prior art (see document D1) being placed in the preamble; see PCT Guidelines PCT/GL/3 III, 2.3a..

3. Reference signs in parentheses should be inserted in the claims to increase their intelligibility, Rule 6.2(b) PCT. This applies to both the preamble and characterising portion.

4. It is not at present apparent which part of the application could serve as a basis for a new claim which would satisfy the criteria set forth in Article 33(1) PCT. Should the applicant nevertheless regard some particular matter as suitable an independent claim including such particular matter should be filed taking account of Rule 6.3(b) PCT. The applicant should also indicate in the letter of reply the difference vis-à-vis the state of the art and the significance thereof.

5. In order to expedite further examination you are requested to indicate with your reply the locations in the application as originally filed of the passages forming a basis for the amendments.

SECTION VIII----------

Although claims 1, 19, 48 and 35, 47 have been drafted as separate independent claims, they appear to relate effectively to the same subject-matter and to differ from each other only with regard to the definition of the subject-matter for which protection is sought ..and/or.. in respect of the terminology used for the features of that subject-matter. The aforementioned claims therefore lack conciseness. Moreover, lack of clarity of the claims as a whole arises, since the plurality of independent claims makes it difficult, if not impossible, to determine the matter for which protection is sought, and places an undue burden on others seeking to establish the extent of the protection.
Hence, the above mentioned claims do not meet the requirements of Article 6 PCT.

In order to overcome this objection, it would appear appropriate to file an

amended set of claims defining the relevant subject-matter in terms of a minimum (i.e. one) number of independent claims in this category followed by dependent claims covering features which are merely optional (Rule 6.4 PCT).

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Correspondence with the EPO on PCT Chapter II demands

In order to ensure that your PCT Chapter II demand is dealt with as promptly as possible you are requested to use the enclosed self-adhesive labels with any correspondence relating to the demand sent to the Munich Office.

One of these labels should be affixed to a prominent place in the upper part of the letter or form etc. which you are filing.